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No. 7.—STRAIN 19 AND THE CONTROL OF BRUCELLOSIS*

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For the final scientific session of the Association's Congress, at which this paper was discussed, the well-maintained attendance at the Technical College at 11.30 on Friday, September 8th, bore witness to the interest of members in the subject.

Introducing the essayist, the Chairman, Mr. Geo. N. Gould, M.R.C.V.S., of Southampton, Hon. Secretary of the N.V.M.A., said: There can be few of us who do not know about the work Mr. Lawson has done in connection with the investigation into the use of Strain 19. I feel there should be a very lively discussion. I will ask Mr. Lawson to speak to us first. Mr. A. J. Wright will follow him. I regret, however, that Mr. Anderson, the second opener, is not able to be here, so a précis of his paper will be read, and then there will be a general discussion.

Mr. LAWSON: May I say how deeply appreciative I am of the honour the N.V.M.A. has paid me in asking me to give this paper to-day.

In view of the limited time at our disposal and the absence of an epidiascope, I think the best thing I can do is to take Parts I and II as having been read, and would accordingly like to concentrate on Part III and draw your attention to what appear to me to be the salient features. Perhaps any points in the earlier parts of the paper can be brought up in the discussion.

In order that information might be obtained regarding the results of vaccination, observations have been carried out in a number of dairy herds over a five-year period. It should be pointed out that circumstances did not allow us to commence work in all these herds at the same time. Thus, in some herds, vaccination commenced in 1943, in others in 1944, and in the remainder in 1945, the work in some of these last herds having been completed only recently. Wherever possible the procedure was to carry out an initial herd test to establish the degree of infection present. Thereafter the negatively reacting animals were vaccinated as (*a*) calves, (*b*) heifers or (*c*) cows, these categories referring to animals that, at the time of inoculation, (*a*) were over four and under 12 months of age; (*b*) 12 months of age up to breeding and (*c*) had had one or more calves.

In Tables IV, V and VI it will be seen that reference is made to " Titres Indicating Infection " and for purposes of clarity some explanation may be necessary here. Following vaccination, agglutinins appear in the blood stream within several days, increasing steadily, until, in the great majority of cases, the maximum concentration is reacned between the 17th and 22nd days. This concentration lasts for a variable period and thereafter there generally occurs a steady fall, until, eventually, either the lower range of titres, or a return towards the negative status is reached. Once this has taken place any significant rise in titre can only be taken as indicating " infection." Thus, in all herds any vaccinated animal that, at a later stage, *e.g.*, at a post-calving test, showed a sharp rise in titre, was accordingly designated as having become " infected " and was classified as such.

In the paper the herds have been divided into two groups. Group I comprised 47 herds that were infected with *Br. abortus*, and Group II, nine herds that were free from infection, when the vaccination programme commenced. Group I has been further sub-divided according to whether the herds involved were treated with one, two, or three doses of S. 19. Group I (A) comprised 28 herds in which the negatively reacting cows and heifers were inoculated during the first year, together with all available " calves." In the subsequent years only the calves of six months and over were vaccinated. As you will see in Table IV, the percentage of infection fell from 2·68 in the first year to nil in the fifth. Group I (B), comprising 14 herds, during the first year was treated in a manner similar to Group I (A). At some time after the first year the animals that had been vaccinated as cows, heifers or calves were revaccinated and for the rest of the period all calves vaccinated as " calves " were revaccinated as " heifers " prior to service. In Table V it will be seen how the percentage of infection fell steadily from 4·74 in the first year to nil in the fifth. In Group I (C) (five herds) the adult animals received two doses of vaccine; the young stock three, when they were approximately six, 12 and 18 months of age. Here again the percentage of infection shows a steady drop from 3·33 to nil.

Herds in Group II totalled nine. All had been " agglutination-tested," and had been free from reactors for several years. In one of these herds vaccination was adopted as a precautionary measure, females of all ages over six months being inoculated at the commencement of the programme and, in the succeeding years, calves only as and when they were approximately six months old. No evidence of infection appeared during the five years of observation. In the other eight herds vaccination had been confined to the young stock, the existing policy of blood testing being continued in the adult animals. Towards the end of the second year, however, Brucellosis broke out amongst the unvaccinated cows, in two of the herds, and spread rapidly. All the negatively reacting adult animals throughout were then vaccinated. This group was included mainly to give fuller information on post-vaccination titres, but to me it also acts as an interesting example of how infection can be quickly brought and kept under control (Table VIII).

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To turn to the agglutination tests (Tables II and III), it is interesting to note that of the animals vaccinated as "calves," 67·7 per cent. showed negative readings when tested after their first calving. This figure may be significant from the point of view of the export breeder. In the paper given by Professor Dalling at the International Congress the figure given in this connection was 77 per cent. The difference can be explained by the fact that, in the seven herds quoted by Professor Dalling, the calves were inoculated at around six months of age, whereas in the present work many of the calves would be somewhat older and approaching our age limit, *i.e.*, 12 months. Amongst the more mature animals the figures indicate that adults may retain a low titre for a considerable time, only a comparatively small percentage eventually returning to the negative status.

A further point in connection with the agglutination tests: in all our herds the calves, whenever possible, were subjected to a blood test a month after vaccination. In Table I it will be seen that of 4,496 calves so tested, 5·1 per cent. failed to respond satisfactorily. In this connection I do not suggest that any estimate of the degree of protection conferred can be obtained from a post-vaccination test, but I think it is logical to assume that a satisfactory response can be taken as being an indication that the immunity mechanism has been stimulated.

We turn now to the question of conception in vaccinated stock and I have to express my regrets for this section being in an incomplete form. Amongst agriculturalists, and even amongst our own profession, there has existed a certain amount of prejudice against the use of S. 19, in that it was alleged to be associated with the production of infertility. We have never had any evidence to support this belief. I have here tables showing the complete analysis of conception rates before and after vaccination in several herds and had hoped to demonstrate these with the epidiascope, but perhaps you will allow me to read them. One refers to the N.I.R.D. herd at Shinfield. The conception rates for this herd, for cows and heifers, over a ten-year period were published in the *Empire Journal of Experimental Agriculture* in 1949 and the authors, Messrs. Foot and Ridler, were kind enough to allow me to quote their figures. The percentage of conception to first and second services respectively in 1941-42 was 51·4 and 14·3; in 1942-43, 54·6 and 29·1; and in 1943-44, 43·9 and 15·2. In 1944 all cows, heifers and calves were vaccinated and in the subsequent years all calves as and when they reached the age of six months. The rates for the three following years were 1944-45, 56·0 and 12·1; 1945-46, 63·5 and 13·5; and 1946-47, 64·9 and 14·9.

A further example concerns two herds under the same ownership, in which the adults were inoculated twice, and the young stock three times, at approximately six, 12 and 18 months of age. For the three years prior to the commencement of vaccination the percentage of conception (cows and heifers) to first and second services respectively was as follows: 1941-42, 54·5 and 17·8; 1942-43, 50·5 and 22·6; 1943-44, 60·6 and 20·2. Vaccinations then commenced and during the subsequent years the percentage of conception was 1944-45, 64·5 and 20·2; 1945-46, 60·0 and 16·8; 1946-47, 68·6 and 20·0; 1947-48, 69·6 and 17·1; and 1948-49, 62·2 and 26·2.

I think these figures speak for themselves.

I would conclude by observing how strikingly seldom it is that one nowadays hears of the abortion "storm" that is such a characteristic of Brucellosis in cattle. It may be that there is amongst us a generation of young veterinarians who have never experienced such a "storm" and its disastrous consequences. From my own observations and from those of many able practitioners with whom I have discussed the matter, I would go so far as to say that, with the use of S. 19, the control of Brucellosis in this country no longer exists as a problem.

Strain 19 and the Control of Brucellosis

It is a well-established fact that Brucellosis is one of the diseases of cattle causing major economic loss. In this country the N.V.M.A. Survey Committee Report (1940) estimated that in milk alone the disease caused an annual loss of two and a half million pounds sterling.

The two main methods of control used throughout the world are (1) eradication by means of segregation of infected from healthy animals as indicated by serological tests and (2) preventive inoculation with various vaccines.

Vaccination against Brucellosis has been practised in this and other countries for many years, the vaccines varying from fully virulent to killed cultures of *Brucella abortus*. In this country following the work of Stockman (1914) and M'Fadyean & Stockman (1916) a live vaccine was prepared and used in badly infected herds only. It appears that this vaccine served its purpose in lowering the abortion rate although the danger of establishing infection in vaccinated animals existed. Vaccines composed of cultures of *Brucella abortus* killed by different methods were also used with little success. Later McEwen (1940, 1941 and 1946) obtained promising results with his Strain 45/20 vaccine but subsequent publications of Edwards, de Ropp & McLeod (1945) and Edwards, McDiarmid, de Ropp & McLeod (1946) indicated that this vaccine was not stable and might become more pathogenic for guinea-pigs and cattle, so that in some instances its effects were like those of a fully virulent culture.

In the United States of America, following the experimental work of Buck (1930), Cotton (1933) and Buck & Smith (1934) with strains of *Br. abortus* of different degrees of virulence in calves, one of these, Strain 19, was shown to have high antigenicity and low pathogenicity. The Bureau of Animal Industry in 1936 carried out a large-scale field trial with vaccine prepared from this strain (Mohler & Wright, 1941) the results of which were so encouraging that calfhood vaccination was adopted as an adjunct to the official "Test and Slaughter" policy. Since then Strain 19 has become universally adopted as the vaccine of choice.

Following the recommendation of the Agricultural Research Council, Strain 19 vaccine was introduced into this country in 1942 as a war-time measure and some millions of doses have been prepared and issued from Weybridge. Experimental work (Edwards, McDiarmid, de Ropp & McLeod, 1946) in which mature heifers were used, confirmed the American findings of high antigenicity and low pathogenicity. Further work (Taylor & McDiarmid, 1949) also confirmed the findings of Mingle, Manthei & Jasmin (1941) that the strain was unlikely to alter in character in the animal body.

In the United States of America the use of Strain 19 vaccine in official schemes was confined to calves, but in this country and some others, official recommendations are that

the vaccine may be used in calves over four months of age and in non-pregnant mature females.

The object of this paper is to give the full results of vaccination in a number of dairy herds for a period of five years from the commencement of vaccination. These results are tabulated in Part III. Part II contains a brief description of the investigations made from the laboratory following complaints received from practitioners concerning the effects of vaccination. Part I outlines the preparation of vaccine and the normal sequelae of vaccination.

PART I

Strain 19 is an attenuated strain of *Br. abortus* which is believed to be fixed in its degree of virulence. It is essentially a smooth strain and in the preparation of the vaccine great care is taken to ensure that a minimum of variants are present. At Weybridge the vaccine is prepared in accordance with the methods demonstrated by Dr. Mingle when he visited the laboratory in 1942. The vaccinal organisms, in measured concentration, are suspended in buffered saline and it should be appreciated that no antiseptic or preservative is added. The product is easily destroyed and it is essential that particular attention should be paid to the methods of storing and transit.

Following subcutaneous inoculation of the vaccine there commonly occur certain reactions. At the site of inoculation, the recommended location of which is on the chest wall behind the point of the elbow, a local reaction frequently takes place which may vary considerably in size and intensity. Commencing within about 12 hours, it takes the form of a hot, tense, often painful swelling. Provided that the inoculation technique has been satisfactory the swelling subsides until, within ten days, normality is regained. Where precautions have not been taken to disperse the inoculum by massage unsightly fibrous tumour-like blemishes, which may persist for long periods, sometimes occur. Experimental attempts to produce such swellings at the laboratory were successful and when these were excised and cultured they were found to be sterile. Lack of aseptic precautions may result in abscess formation. Within 24 hours of inoculation there may also take place a sharp rise in temperature which generally does not exceed 105° F. Occasionally, however, the rise may be more marked and temperatures approaching 108° F. have been recorded. This reaction lasts some 24 to 48 hours and frequently is accompanied by the usual symptoms associated with pyrexia, including a reduction of the milk yield in lactating cows. The reduction is usually observed for four or five milkings only and seldom lasts as long as ten days. In cows nearing the end of lactation the reduced milk yields may persist longer and on rare occasions a return to normal yield does not take place. In 1943 in a herd of 107 cows, records of daily milk yields were kept for seven days before, and ten days after, inoculation. This work was carried out under field conditions without unvaccinated controls so that accurate figures cannot be given. The great majority of cows showed no obvious drop in yield, only six animals showed an estimated total loss of 20 to 30 lb., and one an estimated total loss of 86 lb. All returned to normal production within ten days. In a controlled experiment with a small number of cows Holman & McDiarmid (1945) estimated that vaccination of milk cows resulted in a modal loss of 18·5 lb.

Because of the sequelae as outlined it is considered advisable to house vaccinated stock for about four days after inoculation.

PART II

Complaints

During the period between June 1942 and December 1949, 383 visits were made from the laboratory to investigate reports of alleged unsatisfactory results of vaccination. For descriptive purposes these complaints have been classified into the following categories. (1) Local Reactions and Abscess Formation, 28; (2) Systemic Reactions and Diminution of Milk Yield, 20; (3) Titres, 8; (4) Miscellaneous, 3; (5) Deaths, 23; (6) Abortions in Vaccinated Animals, 224; (7) Alleged Infertility, 76. The great majority of these complaints were made during the earlier years when the main body of the profession was not aware of the effects of vaccination. During the period stated over 3,500,000 doses of vaccine were issued. The complaints made under the first four headings call for little comment. With improved knowledge and technique such complaints are now practically non-existent.

Death after vaccination occurred in 17 premises and concerned eight cows, two heifers and 13 calves. In only four cases was it possible to obtain material for bacteriological examination. The following summary shows (1) Animals involved, (2) time of death after vaccination, (3) symptoms and/or *post-mortem* lesions, and (4) results of bacteriological examinations when these have been available. One cow and one heifer (48 hours)—pneumonia and consolidation of lungs; cow (six days)—generalised tuberculosis; cow (36 hours)—septicaemia-haemolytic streptococci isolated; cow (24 hours)—gangrenous udder, lesions of blackquarter—*Cl. septique*; calf (48 hours)—small areas of haemorrhage and blood-stained fluid in peritoneal cavity *Cl. septique*; cow (four to five days)—spreading subcutaneous oedematous swellings—anaerobes; heifer (72 hours)—multiple liver abscesses; calf (24 hours)—endocarditis, petechiae on endocardium, acute congestion of the lungs, no bacteriological examination; four calves (26 to 72 hours)—no noteworthy lesions and no pathogens present; calf (24 hours)—no examination carried out; calf (24 hours)—evidence indicated that the death in this case had occurred through an accident during handling. In the remaining cases, three cows and five calves (24 to 96 hours)—*post-mortem* examinations failed to reveal any lesions and no further examinations had been carried out.

Abortions after vaccination.—Over 36 per cent. of the total number of complaints coming under this heading concerned abortions which had occurred in previously aborted or infected animals. (It was remarkable to find the number of practitioners who believed that the vaccination of infected animals should have beneficial effects.) In 45 herds (20 per cent.) the complaints related to (*a*) grossly infected herds when insufficient time had elapsed for the vaccination programme to become effective; (*b*) herds vaccinated at the height of an abortion "storm" and (*c*) herds in which much movement of stock out of and into the premises had occurred, *e.g.*, during the process of becoming "Attested," with attendant probability of reinfection occurring. In a small number of cases (13) (5·8 per cent.) the investigations were unsatisfactory because of the absence of records and/or co-operation, or because the evidence suggested that only part of the herd, sometimes including the animals involved in the enquiry, had been inoculated. In 27 herds (12 per cent.) it was established that the abortions that had occurred were due to some factor other than *Br. abortus* and inconclusive results were obtained in nine herds (4 per cent.). In 32 cases (14·3 per cent.) undoubtedly there existed heavy infection at the commencement of vaccination, but although the vaccinal results were considered rather poor, the relevant circumstances did not warrant the classification of "breakdowns." What were considered to be true "breakdowns" occurred in 17 herds (7·5 per cent.). In these cases the results varied from poor to very bad—in eight of these cases the vaccine did not appear to have had

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any effect on the control of the disease. The worst case encountered was in a herd where 13 out of 24 vaccinated heifers aborted their first calves.

Apart from these last-described failures, the general results throughout the country have been found to be increasingly satisfactory. In the great majority of cases the unsatisfactory results have been reported during the first or second year of the vaccination programme and it has been rare to find any untoward happenings once the disease has been brought under proper control. When vaccination was first introduced into many of these herds infection was heavy and widespread and no methods of hygiene or control had been employed. During the course of the investigations, in any herd in which the abortion or infection rate had appeared unduly high, a practice was made of recommending the institution of a system of re-vaccination. This procedure appears to have justified itself time after time, for when subsequent enquiries have been made, uniformly favourable results have been reported by the practitioners concerned.

Alleged infertility after vaccination.—The complaints under this section have covered such a variety of breeding problems, many of which are obscure, that it must suffice to classify them into broad categories and intimate any findings that have been made. (A) Bull found to be either sterile or infertile—7. (B) Probable aftermath of Brucellosis storm—13. (C) Trichomoniasis—2. (D) *C. pyogenes* infection—4. (E) Vaginitis—8. (F) Infertility as prevalent in non-vaccinated as in vaccinated animals—4. (G) Infertility as prevalent prior to the commencement of vaccination—4. (H) Normal breeding in cows and infertility confined to heifers (oestral cycle normal)—3. (I) Normal breeding in heifers and trouble confined to cows—1. (J) Anoestrus in heifers—5. (K) Infertility present in varying degrees but no diagnosis made—25. (L) *Vibrio foetus* infection—4. (M) Suspected *Vibrio foetus* infection—2.

The diagnoses of *Vibrio foetus* infections were made during 1948 and 1949 and, in the light of that and other recent work, the author is of the opinion that a proportion of the herds classified above in the undiagnosed category were, from their history, probably infected with this organism.

No evidence was obtained to suggest that vaccination with Strain 19 was associated with the infertile conditions encountered.

PART III

Control of Abortion in the Herds

In order that precise information of the results of vaccination could be available a number of herds of dairy cattle has been kept under observation for a period of five years following the introduction of vaccination as a control measure. These herds number 56 and this total is divided into two groups which will be considered separately. Group I consists of 47 herds which had a clinical history of *Br. abortus* infection. In 45 of the herds agglutination tests were carried out on every animal before vaccination commenced and the over-all incidence of *Br. abortus* infection found to be 39·6 per cent. In two herds, however, no opportunity was available of carrying out complete tests but the incidence of Brucella abortion was very high, and it was estimated that the incidence of infection present was over 45 per cent. Group I is further divided according to whether the animals received (A) one, (B) two, or (C) three, doses of vaccine and each of these will be considered separately. Infected animals were retained in the herds. Group II consists of nine herds, all of which were free from infection when vaccination commenced.

Throughout the work the animals involved are classified as "Calves," "Heifers" and "Cows." "Calves" refer to animals up to 12 months old, "Heifers" refer to animals over 12 months old up to breeding age and "Cows" refer to animals which had bred. The breeds of cattle involved were Jerseys, Guernseys, Shorthorns, Friesians and Ayrshires. There was no apparent difference in the results of vaccination attributable to breed.

Arrangements were made to have all aborted foetuses examined, and in all examinations made the procedure was to sow duplicate cultures, one set being incubated in 10 per cent. CO_2, and the other in air. All strains of *Br. abortus* recovered proved to be CO_2 sensitive. Cultural examinations were always followed up by biological tests. All agglutination tests were carried out at the Laboratory using standard antigen and agglutination technique.

Wherever possible calves were subjected to a blood test about one month after vaccination and agglutination tests carried out on their sera. In all 4,496 calves were tested and a titre of 1 : 80 and above was regarded as being evidence of a satisfactory response to the vaccine. Only 282 (5·1 per cent.) failed to agglutinate to this level and those calves giving negative or low titres were revaccinated. After revaccination, 30 were not tested, 179 responded satisfactorily and of the remaining 23, four failed to show any agglutinins even after repeated inoculations, five showed a maximum titre of 1 : 40 after two further doses and 14 failed to agglutinate higher than 1 : 80 after a further inoculation.

These post-vaccination tests are shown in Table I.

Table I

Agglutination Reactions in Calves One Month After Vaccination

4,496 calves tested with the following results:—

Below 1 : 80	1 : 80	1 : 160	1 : 320	1 : 640	1 : 1,280	1 : 2,500	1 : 5,120
232	604	1,410	1,268	644	301	30	7

Agglutination tests were carried out on the majority of the vaccinated animals. Details of the results are included in Table II and a summary is given in Table III.

Table III

Comparison of Percentages of Reactions

Time of vaccination	Percentages showing titres less than 1 : 20				
	Pregnancy after vaccination				
	1st	2nd	3rd	4th	5th
"A" Calf ...	67·7	69·2	72·9	69·7	—
"B" Calf and heifer ...	16·3	27·2	34·6	37·9	—
"C" Calf, calf and heifer	15·0	16·6	18·5	27·3	—
"D" Calf and cow ...	—	2·3	14·9	21·7	—
"E" Heifer	13·5	24·7	27·0	35·0	35·3
"F" Heifer and cow ...	—	—	2·4	2·2	4·0
"G" Cow	6·2	8·9	14·4	20·3	25·1
"H" Cow and cow ...	—	1·0	2·0	3·3	2·0

Group I (A) Single Vaccinations

This section comprised 28 herds in which the negatively reacting cows and heifers were vaccinated during the first year together with the available calves over six months of age. In the subsequent years only the calves over six months

TABLE II

SUMMARY OF RESULTS OF AGGLUTINATION TESTS IN VACCINATED ANIMALS

When vaccinated	Time of test	No. of animals tested	Titres						
			Negative	1 : 10	1 : 20	1 : 40	1 : 80	1 : 160	1 : 320
"A" Calf	1st pregnancy	2,969	1,237	753	679	245	55	—	—
	2nd "	1,158	547	255	242	87	27	—	—
	3rd "	492	247	112	100	31	2	—	—
	4th "	109	46	30	23	10	—	—	—
	5th "	—	—	—	—	—	—	—	—
"B" Calf and heifer	1st "	649	35	71	245	161	122	15	—
	2nd "	231	24	39	84	66	18	—	—
	3rd "	107	9	28	45	18	7	—	—
	4th "	29	6	5	8	7	3	—	—
	5th "	—	—	—	—	—	—	—	—
"C" Calf, calf and heifer	1st "	293	8	36	116	97	32	4	—
	2nd "	151	5	20	67	41	16	2	—
	3rd "	54	3	7	21	18	5	—	—
	4th "	11	1	2	3	3	2	—	—
	5th "	—	—	—	—	—	—	—	—
"D" Calf and cow	1st "	—	—	—	—	—	—	—	—
	2nd "	261	2	4	74	92	58	27	4
	3rd "	215	9	23	80	81	21	1	—
	4th "	115	8	17	45	36	8	1	—
	5th "	4	—	—	3	1	—	—	—
"E" Heifer	1st "	1,088	56	91	287	362	243	48	1
	2nd "	821	69	134	268	206	125	17	2
	3rd "	500	58	77	194	118	50	3	—
	4th "	248	35	52	88	58	13	2	—
	5th "	51	10	8	18	13	2	—	—
"F" Heifer and cow	1st "	—	—	—	—	—	—	—	—
	2nd "	46	—	—	9	9	18	10	—
	3rd "	164	2	2	26	47	47	38	2
	4th "	137	—	3	34	59	33	8	—
	5th "	98	—	4	31	37	22	4	—
"G" Cow	1st "	1,303	31	50	164	345	464	216	33
	2nd "	1,273	44	70	261	385	382	118	13
	3rd "	553	41	39	127	180	138	28	—
	4th "	417	45	40	125	121	77	9	—
	5th "	135	12	22	35	48	18	—	—
"H" Cow and cow	1st "	—	—	—	—	—	—	—	—
	2nd "	187	—	2	18	37	73	51	6
	3rd "	288	2	4	42	80	115	40	5
	4th "	242	2	6	49	84	90	11	—
	5th "	97	1	1	23	30	42	—	—
		14,496	2,595	2,007	3,634	3,213	2,328	653	66

of age were inoculated. Generally speaking, then, each animal in this section received one dose of vaccine, as a cow, heifer or calf. In as far as it was possible only the negatively reacting adults were originally vaccinated but on occasions a reacting animal inadvertently received a dose of vaccine. These cases have, of course, been classified as "infected" animals. This applies to all herds in Group I (A), (B) and (C).

Results are shown in Table IV. (*Overleaf*)

GROUP I (B) DOUBLE VACCINATION

This section comprised 14 herds which during the first year of the scheme were inoculated in a manner similar to that of Group I (A). At some time after the first year, however, the adult animals which had been vaccinated as cows, heifers or calves were revaccinated and received no further inoculations during the rest of the period of observation. Calves vaccinated as calves were revaccinated as heifers at some time prior to service and they, too, received no further inoculations. Each animal in this section thus received two doses of vaccine.

Results are given in Table V. (*Overleaf*)

GROUP I (C) TRIPLE VACCINATION

In this section of five herds, four were treated as follows. All negatively reacting cows and heifers were inoculated during the first year and were revaccinated after calving. The calves were vaccinated at approximately 6, 12 and 18 months of age and thereafter received no treatment. In the fifth herd this procedure was not adopted until after the first year had elapsed, the animals in the interim period having been vaccinated as cows, heifers or calves. Generally speaking, then, the original adult portion of the herds received two doses of vaccine and the young animals, three doses.

Results see Table VI. (*Overleaf*)

GROUP II

Free from infection when vaccination commenced.—Herds in this group totalled nine, eight of these being under the same ownership. All were "agglutination tested" and had been

TABLE IV

GROUP I (A) *Single Vaccinations*—ANIMALS VACCINATED ONCE AS COWS, HEIFERS AND CALVES
28 herds

Year of scheme	Animals originally negative (vaccinated)							Infected animals (not vaccinated) †			
	Pregnancies involved		Abortions			Titres indicating infection	Percentage of infection*	Pregnancies involved		Abortions	
	Total	Normal	No.	Percentage	Positive			Total	Normal	No.	Percentage
1st	1,082	1,034	48	4·53	21	8	2·68	372	333	31	8·33
2nd	2,554	2,267	57	2·23	21	13	1·33	317	287	31	9·77
3rd	1,920	1,850	52	2·7	14	7	1·09	185	167	18	9·72
4th	1,811	1,757	54	2·9	4	Nil	0·22	131	125	6	4·57
5th	2,160	2,108	52	2·4	0	0	0	63	63	0	0
Totals	9,527	9,016	263	2·76	60	28	0·92	1,068	975	86	7·9

* Percentage of infection includes evidence of *Br. abortus* infection from the results of some agglutination tests.
† Most of these animals were originally Positive and therefore not vaccinated. The group, however, includes some Positive animals which were inadvertently vaccinated and some which were in the originally Negative group but subsequently became infected.

TABLE V

GROUP I (B) *Double Vaccinations*—ANIMALS VACCINATED AS COW AND COW, HEIFERS AND COW, CALF AND COW, AND SUBSEQUENTLY AS CALF AND HEIFER
14 herds

Year of scheme	Animals originally negative (vaccinated)							Infected animals (not vaccinated) †			
	Pregnancies involved		Abortions			Titres indicating infection	Percentage of infection*	Pregnancies involved		Abortions	
	Total	Normal	No.	Percentage	Positive			Total	Normal	No.	Percentage
1st	590	565	25	4·23	16	12	4·74	207	192	15	7·43
2nd	997	958	39	3·91	17	18	3·61	124	115	9	7·17
3rd	1,086	1,067	19	1·74	5	1	0·55	95	88	7	7·36
4th	1,062	1,030	32	3·01	5	0	0·47	52	49	3	5·76
5th	1,012	990	22	2·17	0	0	0	35	34	1	2·85
Total	4,747	4,610	137	2·88	43	31	1·55	513	478	35	6·84

* Percentage of infection includes evidence of *Br. abortus* infection from the results of some agglutination tests.
† Most of these animals were originally Positive and therefore not vaccinated. The group, however, includes some Positive animals which were inadvertently vaccinated and some which were in the originally Negative group but subsequently became infected.

TABLE VI

GROUP I (C) *Triple Vaccination*—ANIMALS VACCINATED AS COW AND COW, HEIFER AND COW, CALF AND COW, AND IN SUBSEQUENT YEARS AS CALF, CALF, AND HEIFER
Five herds

Year of scheme	Animals originally negative (vaccinated)							Infected animals (not vaccinated) †			
	Pregnancies involved		Abortions			Titres indicating infection	Percentage of infection*	Pregnancies involved		Abortions	
	Total	Normal	No.	Percentage	Positive			Total	Normal	No.	Percentage
1st	177	169	8	4·51	4	2	3·33	77	69	8	10·38
2nd	291	283	8	2·74	1	2	1·03	45	41	4	8·88
3rd	321	312	9	2·8	1	1	0·62	28	26	2	7·14
4th	352	339	13	3·69	1	0	0·28	17	15	2	11·76
5th	351	341	10	2·84	0	0	0	10	10	0	0
Totals	1,492	1,444	48	3·21	7	5	0·8	177	161	16	9·03

* Percentage of infection includes evidence of *Br. abortus* infection from the results of some agglutination tests.
† Most of these animals were originally Positive and therefore not vaccinated. The group, however, includes some Positive animals which were inadvertently vaccinated and some which were in the originally Negative group but subsequently became infected.

TABLE VII

SUMMARY OF PERCENTAGES OF ABORTION AND INFECTION IN THE INFECTED HERDS

Year after vaccination commenced	Group I A Single vaccinations		Group I B Double vaccinations		Group I C Triple vaccinations	
	Animals originally negative vaccinated as C, H or CA†	Animals originally infected* unvaccinated	Animals originally negative vaccinated as C & C, H & C, CA & C or CA & H†	Animals originally infected* unvaccinated	Animals originally negative vaccinated as C & C H & C, CA & C or CA, CA & H†	Animals originally infected* unvaccinated
1st	4·53 (2·68)	8·33	4·23 (4·74)	7·43	4·51 (3·33)	10·38
2nd	2·23 (1·33)	9·77	3·91 (3·61)	7·17	7·74 (1·03)	8·88
3rd	2·7 (1·09)	9·72	1·74 (0·55)	7·36	2·8 (0·62)	7·14
4th	2·9 (0·22)	4·57	3·01 (0·47)	5·76	3·69 (0·28)	11·76
5th	2·4 (0)	0	2·17 (0)	2·85	2·84 (0)	0

* Many of these animals were originally positive and therefore not vaccinated. The groups, however, include some positive animals which were inadvertently vaccinated and some which were in the originally negative groups and subsequently became infected.
† C = Cow. H = Heifer, *i.e.*, an animal over 12 months old and up to breeding. CA = Calf, *i.e.*, an animal over four months and under 12 months of age.

free from reactors for several years. In the single herd vaccination was adopted as a precautionary measure, and all the cows, heifers and calves of six months of age upwards were inoculated during the first year of the scheme. Thereafter only the calves were vaccinated, at approximately six months of age. No evidence of infection appeared during the five years of observation.

In the other eight herds vaccination had been confined to the young stock, the existing policy of blood testing being continued in the adult animals. Towards the end of the second year, however, Brucellosis broke out amongst the cows (unvaccinated) in two of the herds and spread rapidly. All the negatively reacting cows were then vaccinated in all the herds and any replacements, *i.e.*, freshly calved first-calf cows which had been vaccinated as calves, were revaccinated prior to entrance to the two infected farms. All animals showing signs of infection were removed immediately. These herds have been included mainly to give further information on post vaccinal titres.

Conception rates.—The analysis of the conception rates in the herds under observation has not yet been completed and will be reported later. No evidence was found to suggest that vaccination with Strain 19 impaired the fertility of the vaccinated animals.

TABLE VIII. GROUP II

ANIMALS VACCINATED AS COWS, HEIFERS OR CALVES NINE HERDS FREE FROM INFECTION WHEN VACCINATION COMMENCED

Year	Animals originally negative (vaccinated)						
	Pregnancies involved		Abortions			Titres indicating infection	% of infection
	Total	Normal	No.	%	Pos.		
1st	14	14	0	0	0	0	0
2nd	203	194	9	4·43	0	1	0·49
3rd	529	514	20	3·78	5	5	1·89
4th	744	717	27	3·62	1	1	0·26
5th	799	758	41	5·13	0	0	0
Totals	2,289	2,197	97	4·23	6	7	0·56

SUMMARY

The article deals briefly with the investigations made into reported unsatisfactory results of Strain 19 vaccination in the field and describes the control of *Br. abortus* infection in 47 herds by vaccination with Strain 19. The observations were made for a period of five years following the introduction of the vaccination scheme. Of the 47 herds, 28 were inoculated once, 14 twice, and in five herds the adults received two doses and the young stock three. In all herds all cows and heifers showing a titre of less than 1 : 20 were inoculated during the first year. In the single inoculated herds, in the same and in subsequent years all calves were vaccinated. The vaccinated adult stock in the double and triple vaccinated herds were revaccinated some time after calving; in these groups, however, the calves vaccinated as calves were revaccinated (A) as heifers prior to service (double vaccinated herds) or (B) as yearlings and again prior to service (triple vaccinated group). The original over-all incidence of infection present was about 40 per cent. and infected animals were retained in the herds.

Agglutination tests were carried out on sera of vaccinated calves about one month after vaccination and about 5 per cent. of cases failed to develop titres of 1 : 80 above. Such calves were revaccinated. Repeated agglutination tests were carried out at intervals on a considerable number of the vaccinated animals. Animals vaccinated as calves showed an incidence of about 27 per cent. which retained titres of 1 : 20 or above for at least three pregnancies; the remainder showed titres below 1 : 20 by the time of their first calving. About 73 per cent. of animals vaccinated as heifers retained titres of 1 : 20 or above for at least three pregnancies. Many animals vaccinated as adult cows failed to show titres below 1 : 20 during the five years of observations.

Br. abortus infection amongst vaccinated animals never exceeded 5 per cent. and was completely absent before the end of the fifth year.

A further nine herds which were initially free from *Br. abortus* infection were also vaccinated with Strain 19. The results obtained in these herds are included mainly to give further information on post-vaccinal titres.

Acknowledgments.—The writer wishes to express thanks and appreciation to the many veterinary surgeons who have co-operated in the scheme; to Professor Dalling for his constant help and encouragement throughout the work; to

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Dr. Stableforth for his help and guidance in the setting out of the tables; to Mr. P. N. H. Grant for his assistance in the collection of data and blood samples; to Mr. J. E. Wilson and Mr. R. O. Muir, of Lasswade, for examining the foetuses from the Scottish herds; and to Mr. L. Weston and Miss P. Pyatt and certain other members of the technical staff at Weybridge for their assistance and industry in the laboratory work involved.

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Discussion

Mr. A. J. Wright, M.R.C.V.S. (Macclesfield): Firstly, I would like to express to the Provisional Committee my appreciation of the honour they have accorded to me in inviting me to open the discussion on this paper at their Congress.

I would also like to thank Mr. Lawson for his excellent paper, which is a very practical and comprehensive survey of the use of S. 19 vaccine in the control of Brucellosis in cattle in this country, showing as it does the results obtained under field conditions in a large number of herds kept under varying conditions and over a considerable length of time, whilst also giving the results of thorough investigations into the complaints regarding the use of S. 19: the difficulties and so-called breakdowns, all of which I am certain we in the field have encountered and from which in many instances we have suffered many anxious and worrying times in trying to answer and explain to the farmer.

I am confident that the observations and conclusions in this paper will be of great service to a large number of practitioners, particularly the younger and less experienced members of the profession, as it will give in general a concise picture of the results—the difficulties and the general successful and scientific use of S. 19 in the control of Brucellosis in our herds.

Before I commence to discuss the paper in detail I would like to point out that many of my observations and remarks may seem to many to be exaggerated and to some open to much criticism and doubt, but these remarks are based solely on observation and experience gained in my own particular area in Cheshire, where the cattle population is very dense and where for generations past the vast majority of dairying herds have been predominantly flying, where young cattle, chiefly first calving heifers, often from Ireland, are always being imported either newly calved or just at calving, kept for one or two, rarely more, lactations and then sold for beef. The result has been that practically the whole herd has changed every two to three years, and, as you can well imagine, infection is very high in practically every farm; in fact it is so high that many years ago I gave up blood testing as in nearly every case the percentage of positive blood samples was so high, often near 100 per cent. I can say truthfully that in my fairly large dairying practice I have had only one herd, a pedigree herd, that was blood tested and kept free. On unvaccinated farms it was quite a common experience to have up to 70 to 90 per cent. of the young or freshly imported calving animals abort their calves due to infection with *Brucella abortus*, resulting in a tremendous loss to the owners and the country as a whole.

Ever since the introduction of S. 19 vaccine I have tried many different sites of inoculation in an endeavour to eliminate the formation of painful and permanent local reactions and I am now definitely of the opinion that the best site is high up at the junction of the neck and shoulder at the antero-superior edge of the supra-scapula process, vigorous massage after injection being very important. Since adopting this site the proportion of very painful and permanent swellings has been reduced to a very small percentage, and where circumscribed permanent swellings have occasionally resulted, excising and evacuating the sterile contents has effected the disappearance of any outward blemish. I disagree with the writer that the best site of injection is on the chest wall behind the elbow, for in my experience this is one of the most sensitive sites on the body and, in spite of restraint, animals, particularly strong heifers, object most violently and one is often in great danger of being kicked and injured.

With regard to systemic reactions, I agree mainly with those described by the author, although in many cases they persist for much longer than 48 hours, and I have formed an opinion—rightly or wrongly, and without definite proof—that certain batches of vaccine give rise to more numerous or severe reactions than do others. I have rarely seen much evidence of systemic reactions in calves and maiden heifers resulting from vaccination. I feel the author has very much under-emphasised the serious reduction in milk yield that may often occur. The loss of milk in the herd of 107 cows which he recorded is in my experience much less than that which takes place in a great number of herds.

It has been my practice now for some years wherever possible to insist on vaccinating cows in milk as soon as possible (ten to 21 days after calving), as I have found that if the milk yield drops it is temporary and the animal will return to her full yield, whereas if the milking cow is vaccinated near the middle or in the latter part of her lactation, if there is a reduction in yield it will often persist and frequently the cow goes nearly dry and remains so, thus causing much loss and annoyance to the owner, and in many cases vaccination with S. 19 becomes unpopular.

Part II deals with complaints and I think all of us will agree with the observations and facts in this section of the paper; all engaged in dairying practice will have encountered these complaints, the explanations of which are in accordance with those recorded in the paper. However, there is one sentence in this part of the paper with which I cannot agree—and here I humbly make a confession: I am one of those numerous practitioners who believe firmly that vaccination of the infected animal does have beneficial effects, and I know this view is held strongly by a host of farmers who have had considerable experience of contagious abortion before and after the introduction of S. 19. As stated previously, when I commenced blood sampling in my area, the percentage of positive blood samples was extremely high and in these flying herds, records showed that for years there had been a high percentage of abortions, but this percentage immediately dropped considerably and in many cases clinical abortions ceased directly S. 19 vaccination was introduced and maintained. I will go even further and say that I have been forced to believe from observations and a few records I have been able to keep, that the vaccination of animals that actually have aborted has definitely shown beneficial results and the number of young cows that aborted a second or third time was definitely reduced.

I can quite understand the author and other scientific workers being in complete disagreement with these views and putting forward many reasons and theories why this is all imagination on my part—indeed, I expect it—but I am afraid that they will not convince me and particularly my clients that vaccination of an infected animal or maybe animals that have aborted is a waste of time, vaccine and money. I would like to point out to Mr. Lawson in this connection that in his paper he states, "When vaccination was first introduced into many of these herds, infection was heavy and widespread and no methods of hygiene and control had been employed. During the course of the investigations, in any herd in which the abortion or infection rate had appeared unduly high, a practice was made of recommending the institution of a system of revaccination. This procedure appears to have justified itself time after time, for when subsequent enquiries have been made, uniformly favourable results have been reported by the practitioners concerned." Of all the complaints

and objections we practitioners have had to deal with after the use of S. 19, I think the most common and persistent has been the assertion that increased infertility has resulted; but I am firmly convinced after careful observation, helped by a few records, that there is not the slightest foundation for incriminating S. 19 in any way as the cause of infertility.

There are, however, two causes of premature calving which may be wrongly ascribed to a breakdown of S. 19 and which do not appear in this paper and I think occur frequently enough to warrant mention. Firstly, quite a number of sporadic abortions occur as the result of external injury, particularly in the horned breeds from "hiking" one another, and also from serious falls in the shippons and elsewhere. Secondly, I have found that occasionally during the last 20 years in practice, practically all the calves produced as the result of mating with a few certain bulls are born a few weeks prematurely, this condition being immediately remedied by the use of a fresh sire. In both the above cases of abortion, laboratory examination of the aborted foetus or calves has failed to reveal any causal organisms.

Part III of the paper deals with the control of abortion and the results obtained by single, double and triple vaccination of herds. It is here that I am surprised at the results shown in Tables IV, V, VI, and VII; as you will remember, the percentage of abortions in each group shows very little difference. My experiences in the field have been that the percentage of abortions shows a marked decrease where double and triple vaccinations have been made.

A single vaccination of calves only has without any doubt not proved the remedy for the control of abortion in our heavily infected herds and this conclusion is upheld by the majority of my colleagues dealing with dairy herds similar to those in my area.

Where calves have been vaccinated once only, we frequently find a large proportion of these animals abort at their second calving, and it is essential that we vaccinate again after their first calving and often, in very heavy infections, again for the third time after the third calving.

It is my belief now, from records and observations that I have made, that the immunity produced in the calf is greater when the vaccination is left as late as possible, that is, a month or two before its first mating. Some of my colleagues have introduced a system of injecting S. 19 into the calf when it is about six months old and then reinforcing this by a second injection just prior to mating; they state that there is positive evidence that a greater and more lasting immunity is produced by this method, and I would like to ask Mr. Lawson if he has any evidence to support this method.

I must repeat, however, that in heavily infected semi-flying herds, the single vaccination of calves *is not* sufficient to prevent abortion, particularly at the subsequent second and third calvings. If on economic grounds or where sufficient supplies of vaccine are not forthcoming, only a single vaccination has to be made, then I would make that vaccination directly after the first calving before second pregnancy; quite satisfactory results can be expected by this method and definitely far better results than if only the calves had received a single dose.

As a result of these experiences, I have been rather perturbed about the leaflets, literature and articles published by the Ministry on the vaccination of calves, for they have definitely given the impression to many stock owners that once the calves have been vaccinated then all will be well.

Since S. 19 vaccine was introduced I have tried to gain evidence giving some indication of the duration of immunity or freedom from abortion one might expect after adult animals had received single or double vaccination. From my few records, these few being chiefly from herds that were in the "panel scheme" and where some of the cows had been kept breeding for several years, I could not form any definite concrete conclusions, except that in quite a number of cases cows have commenced aborting again four to six years after vaccination, suggesting that where fresh and heavy infection is present there is a danger of renewed abortions in about four years.

In the light of my observations, experiences and results obtained in the type of dairy herds which predominate in my area, the routine practice which I adopt for the control of abortions due to *Brucella abortus* is the vaccination of the maiden heifer some weeks before mating, followed by a second injection immediately after the first calving—this injection being the most essential and important—and in many cases where infection is very high a third injection after the third calving. Where the procedure is continued regularly every year—and I emphasise regularly every year—the results obtained have been very good indeed and abortions due to *Brucella abortus* have disappeared almost entirely from these herds. Unfortunately some farmers have not continued with these regular vaccinations because abortions had disappeared from their herds, with the result that in a very short time their fresh young cows have commenced aborting again very frequently.

In spite of all that I have said, I realise fully that in many large areas of this country where self-contained herds predominate, where infection is very low and where the chance of re-introducing infection is very slight, the routine I have adopted may not be necessary and in all probability the vaccination of maiden heifers will suffice to control abortion. In my opinion, the discovery and introduction of S. 19 vaccine by the veterinary profession has been one of the greatest and most beneficial contributions to the stock owners and to the country, and the dividends which farmers have reaped and are reaping from the small cost to them of the vaccinations are colossal.

I was rather sorry to see no mention in Mr. Lawson's paper of the recent work done at Compton on the results obtained by the use of very small doses of S. 19 intradermally and sincerely hope that further work will be carried out with this method, as the elimination of systemic and local reactions, besides the tremendous saving in the quantity of vaccine to be manufactured, would be a great step forward.

I think it would be very interesting to us all if the author could give us any statistics on the results of his *post-mortem* examinations of aborted calves showing the other causes of abortion and the percentages in each case.

In conclusion, I must confess that my somewhat disjointed remarks are of a very low and poor scientific standard, but only hope that they are of such a controversial nature that they will be challenged and criticised and thus lead to a lively and instructive discussion.

The Chairman: We have now a contribution from Mr. Anderson, who is not here. It consists of six foolscap pages; can I have your permission to just give you the material points, and the whole paper will be published at some future date.

We are rather looking forward to hearing from Dr. A. B. Crawford, of the United States Department of Agriculture, and I am certain he has some information we would very much like to hear.

If you would agree to my suggestion we could finish in reasonably good time. (The meeting agreed.)

The Chairman then gave a short *résumé* of Mr. Anderson's paper, the full text of which is as follows:—

Mr. Guy Anderson, D.V.M., M.R.C.V.S. (Aylesbury): The control of Brucellosis is one of the greatest contributions which the veterinary profession can make to the livestock industry and tremendous strides have been made during the last ten years, particularly with the introduction of the two types of vaccine—Strains 45/20 and 19.

Mr. Lawson has discussed in some detail carefully controlled work done at Weybridge. Mr. Wright has discussed the subject from the point of view of his experience amongst flying herds, and I would like to speak for a few moments on a fairly general basis and also of the picture which I see in my own district which is largely a dairying area where the majority of herds are self-contained.

It is, broadly speaking, true to say that there was little we could do in the control of contagious abortion prior to 1941, and at that time the disease was extremely widespread throughout the whole country. Many herds were kept clear by the testing and eradication method, but inasmuch as they were continually exposed to infection or re-infection it seems to me that there was, and still is, a large element of luck in this method of control.

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Many herd owners found that it was possible to eradicate Brucellosis by this method only so long as they did not mind eradicating all their cows as well.

There seems little doubt that the old virulent vaccine had some value in lowering the incidence of abortions within a heavily infected herd, but little controlled work was done on this, and in many cases I think the good that was attributed to the vaccine was the result of the disease running its natural course. The nature of the vaccine prevented its use as a means of prophylaxis and by the time one attempted to use it as a cure, the harm was done.

Mr. Lawson has said, "Since then S. 19 has become universally adopted as a vaccine of choice." I am not quite satisfied that this is a true statement. I think it has become universally adopted as the vaccine of necessity, inasmuch as it has received so much official sanction, not only from the Ministry of Agriculture, but also from the Ministry of Health in herds holding a T.T. Licence. It should be borne in mind, however, that Strain 19 is not a perfect vaccine. There are snags associated with its use and we still have a lot to learn about its action. S. 45/20, on the other hand, appeared to be extremely efficient in protecting animals over comparatively short periods and did not have the great disadvantage of a resulting positive agglutination titre. One cannot question the validity of the work which showed that this strain was not absolutely fixed, but it seems a great pity that in the tremendous publicity which has been given to S. 19 further work along the lines of S. 45/20 appears to have been abandoned.

I still feel that in some respects we are acting empirically in using S. 19 vaccine, and I have been one of the strongest critics of a system of calfhood vaccination in this country. S. 19 was of particular use, as the opener has remarked, in the U.S.A., where it was contingent on the test and slaughter policy amongst adults, but in this country no such policy could, or does, exist, and it still seems to me that we are spending a great deal of time protecting our animals against abortion at a time when they are not exposed to infection, and have not given nearly enough attention to the question of revaccination of adults when they come into a dairy herd after calving and so become exposed to infection.

I have been endeavouring to find out for very many years just how long the immunisation conferred by inoculation with S. 19 vaccine lasts, and I am still awaiting an answer to this question. I hope perhaps the speaker can enlighten us on this point because it is fundamental to the intelligent use of this vaccine.

Again, the speaker has referred to revaccination both double and treble, but has given very little lead as to what he believes to be the best time for revaccination. It must be remembered that unfortunately one must develop some form of routine in disease control in practice and therefore we must know the optimum time for revaccination. It has been my own practice to revaccinate at the end of the first pregnancy and results (uncontrolled) would appear to be satisfactory, but the positive agglutination titre which results from this adult vaccination is certainly undesirable. Experience has shown that the immunity is unlikely to last for more than three or at most four years. In herds in which originally all the animals were vaccinated and then for several years only the calves, outbreaks of abortion have occurred amongst the cows after three or four years.

I realise now, however, that in spite of my criticisms (which are still theoretically valid) one outstanding feature is the fact that in dairying districts where vaccination has been carried out in fairly large measure, contagious abortion has ceased to become a major disease amongst cattle. Certainly my own experience and that of many other practitioners to whom I have spoken is that an outbreak of Brucella abortion is becoming a rare thing. As mentioned, in these areas vaccination has been carried out on a very wide scale. Within the Scheme for The Control of Diseases of Dairy Cattle, and in many cases by private arrangement with the clients, a fairly methodical system of abortion control has been carried out. In other herds including, unfortunately, many of those under the Ministry's Calfhood Vaccination Scheme, methods have been much more haphazard.

In the light of experience one cannot help feeling that the Calfhood Vaccination Scheme is open to very severe criticism. The vaccination is completely uncontrolled and there is nothing in the scheme which suggests that revaccination should take place. As Mr. Wright has pointed out, the propaganda associated with this scheme was such as to give an entirely exaggerated view of its value and a false sense of security to those taking part in it. I feel very strongly, as evidently does Mr. Wright, that vaccination must be continued within herds for, as far as we know at the moment, an indefinite period. One sees great danger in the fact that as the disease becomes less and less common so stock owners will be less and less inclined to take active steps to protect their herds from it. I do hope that the profession will take every opportunity of stressing the importance of continuing to protect herds by vaccination, at least until we have reached the stage where total eradication may become practicable. I cannot over-emphasise the importance of this, as I have already observed breakdowns in herds in which vaccination has ceased.

It would appear, however, that if there are a sufficient number of immune animals, not only are these animals protected from infection themselves, but they probably act as buffers to the spread of infection to susceptible animals.

I would agree with the speaker that most of the complaints received are probably not valid, and that, broadly speaking, vaccination is extremely safe for use in the field. I notice it is considered advisable to house vaccinated animals for about four days after inoculation. I am rather surprised that such a long period of housing is necessary in view of the fact that symptoms of pyrexia rarely last more than 48 hours. I think, however, it is true to say that in general practice practically no post-operative measures are taken, and very little harm results, although occasionally one meets with an impaired milk yield and calves that are obviously ill for several days. These cases are, however, the exception.

Mr. Wright has pointed out the advisability of vaccinating animals before they reach the peak milk yield. I would go further than him in this, and like to vaccinate animals within about ten days of calving. I think it is safe to vaccinate at any time after four days following a normal parturition. I also agree that the site of inoculation suggested by the speaker is most unsatisfactory and a very dangerous one from the operator's point of view. I give practically all injections into cattle in the area high up over the ribs just behind the scapula, and I have found that the number of local reactions following vaccination in this site is negligible. In fact, I cannot recall having seen more than one unpleasant local reaction.

The desirability of vaccinating all animals which are already infected is open to considerable question. In actual practice where it is decided to adopt a policy of vaccination it is usual to vaccinate all non-pregnant female stock in the herd as a routine, and it seems almost simpler to vaccinate a few animals which are already infected than to go to the trouble and expense of repeated blood testing.

It has always been held by stock owners that an animal which has once aborted will never abort again. I think in many cases in the past they were rarely given the opportunity to do so, because the vast majority of them were fattened out. In my view the question of future breeding of an animal which has aborted will depend very largely upon the amount of damage done to the endometrium and its ability to maintain a satisfactory blood supply to future foetuses. I have known many animals which have aborted two and even three times, but, on the other hand, I have also known a great number of animals which have aborted once due to Brucella and bred regularly and satisfactorily for many years afterwards.

It is gratifying to note that the speaker is satisfied that no infertility can be caused by the use of the vaccine. I am certain that practically all veterinary surgeons support this view, but it is a matter on which it is extremely difficult to convince one's clients, particularly if a mysterious outbreak of infertility occurs shortly after the vaccination programme has been initiated.

It is very interesting to note that since Brucellosis is coming more and more under control other forms of abortion would appear to be becoming more and more common, or at least more and more commonly recognised and diagnosed. This makes one wonder whether the loss due to Brucellosis had been somewhat exaggerated in the past. Mr. Wright has suggested accident as

a very common cause of abortion in cattle. I think in the past when Brucellosis was so common we were inclined to pooh-pooh this suggestion, but, like Mr. Wright, I am coming more and more to the view that it is probably a very significant factor.

The use of a vaccine which gives a positive agglutination titre makes investigations of abortion in vaccinated herds somewhat complex, but has at least what might be termed a reflex advantage in directing attention to other forms of abortion. Trichomoniasis is now a well-recognised condition, and many of us have met abortion due to *C. pyogenes* infection. More recently the significance of *Vibrio foetus* infection has been discussed and it seems almost certain that many early abortions are due to nutritional causes, such as a possible upset in the calcium phosphorus ratio or a slight iodine deficiency.

It is the inevitable challenge of civilisation that as one problem is overcome so more complex ones are presented. Certainly non-Brucellosis types of abortion appear to be very much more difficult to deal with in the field than Brucellosis itself.

General Discussion

Mr. L. Constance (Malmesbury): I am one of the young practitioners with little experience of Brucellosis "storms." I would like to say how much we owe to Mr. Lawson for his work which has been of such inestimable value to the profession and the livestock industry as a whole.

Looking through his figures, one is struck with the fact that, in spite of the most rigid controls, there remains a small percentage of abortions in what are generally well-run, self-contained pedigree herds. With the satisfactory methods of control of Brucellosis which have been achieved in the last few years these apparent breakdowns are assuming a major importance. Recently Mr. Lawson has isolated *Vibrio foetus* from foetuses which had every appearance of a straight forward Brucellosis. It would be very interesting if Mr. Lawson could give us any indication of the possibility of *Vibrio foetus* infection accounting for some of the so-called breakdowns in Brucellosis control.

Dr. J. T. Edwards (London): I should like to deal at once with a point Mr. Wright has raised in opening the discussion and about which he expressed himself as apologetic. It was in connection with the opinion he had formed from his own experience that the inoculation with the customary large dose of Strain 19, of cows which were already infected, was beneficial. He need not in actual fact have offered any apology, for his deduction is in good accord with what we have only very recently learned from experimentation concerning the so-called Interference Phenomenon—a phenomenon which indeed, if we had but understood it earlier, explained the efficacy of a mode of intervention which astounded the world over 60 years ago, namely, the Pasteurian treatment of rabies. A curious finding later seen with some of the important virus diseases has been the rapidity with which severe infection is warded off after preventive inoculation with a weaker virus. That had become most conspicuous in the course of the massive Indian experience in inoculating cattle with the goat-adapted virus as a means of protection against cattle plague (rinderpest). The protection proved fully efficacious even after so short an interval as 48 hours, or less. It had not been anticipated, however, that the time lapse between inoculation and infection could be so much disregarded that animals actually in the early stages of natural attack would be found to recover if they were injected with the weaker virus. That was strikingly brought home to me during my recent experience in eradicating cattle plague in Egypt. So much had the chief veterinary inspector in Upper Egypt (Diferowi bey) gained confidence in the goat virus issued to him that he became emboldened and of his own accord proceeded to inoculate herds in which the disease had already gained a foothold, and then, he averred, the disease vanished. That statement seemed unbelievable until it came to my notice that the distinguished American distemper worker, R. G. Green, had put under report the results of his experiments showing that dogs in the early stages of distemper recovered after inoculation with his ferret-adapted virus. A new form of therapy was thus emerging. The principle of the method, we now understand, is that when a weaker virus gains access to the vulnerable cells in the body the particles of that virus attach themselves to the surface of the cells and there form a covering layer preventing attachment of the particles of the stronger virus, these latter particles having the additional power to penetrate the surfaces, so entering the cells and causing their destruction. It is on the well-known principle, "The meek shall inherit the earth." I had no knowledge that the phenomenon was as yet applicable to any of the bacterial infections, but that is not improbable. If Mr. Wright's finding, again as a shrewd field observer, is therefore corroborated it is to him that the credit for the discovery must be given.

Allow me to make two more points in supplementation of Mr. Lawson's most excellent paper. They are essentially confirmatory of Mr. Anderson's discerning field experience and pointed criticism. The first point is that the protection set up against clinical attack through inoculation with a large dose of any strain of *Brucella abortus*, suitably chosen and of the desired low virulence, is not absolute: it is relative. The second point is that it is not a true immunity—lifelong or nearly lifelong in its effects (as in the case of small-pox or rinderpest vaccination), in which the immunising agent invariably disappears, so far as we know, from the body: it is instead a pre-munity. A high degree of protection lasts, as Mr. Anderson has said, only so long as the animal remains a carrier, and it wanes afterwards sooner or later, depending, it seems, in part at least, upon the age of the animal inoculated, and after an interval vanishes altogether.

Let me insist that there is nothing essentially original or mysterious about the use of the American strain, S. 19, in vaccination against contagious abortion. The principle was originally expounded by no less an authority than Bang himself at the Liverpool Congress in 1906 (*Proc. 24th Gen. Mtg. Nat. Vet. Assoc.*, p. 22) and its validity adequately confirmed experimentally in this country during the following years (*Final Report of Epizootic Abortion Committee*, 1913). Adequate field trials carried out, too, in this country (Stockman, S., 1920, 10th Annual Report of the Development Commissioners) next demonstrated its efficacy as a general preventive measure. Hence, by the time I had the privilege of being invited to address this association on the subject at the Chester Congress in 1921 (*Vet. Rec.*, 1921, **33.** 723, 739) there was a massive body of evidence, both from this country and Germany, in support of that measure.

Two hindrances prevented general adoption. First, the difficulty which Stockman, as Chief Veterinary Officer, experienced in getting practitioners to respond by supplying him with the results of their experiences. Secondly, the hope, based probably largely on what had been his experience with glanders, lingering in Stockman's senior colleague's, M'Fadyean's, mind, that the disease could be eradicated by the detection and elimination of carriers.

Stockman's untimely death, in 1926, saw a decline of interest in the process. Hence, at the Folkestone Congress in 1932, although Andrews, who read the paper on the subject, was well satisfied with the utility of vaccination in the field, actual issues of vaccine from Weybridge remained small. Then, for a time, the method suffered a violent setback from M'Fadyean's condemnation of it (*J. Comp. Path. & Ther.*, 1933, **46.** 50). Even Andrews's subsequent revindication of the method at the Llandudno Congress in 1933 was unavailing. It is to the lasting credit of McEwen that he championed the use of the method meanwhile in this country with laudable persistency.

Strain 19 came into prominence only after the costly failure of the attempt at total eradication in America. There is no reason to think at this date but that Stockman's original Strain 40 or the strain recommended by McEwen would have equally, or nearly equally, achieved the goal so well registered for us now by Mr. Lawson.

Even now, it is most difficult to estimate precisely at their true value the results of the massive field work currently undertaken owing to the difficulty of obtaining controlled results. The most satisfying, so far as I know, are those recently reported from Australia (see review in *Vet. Rec.*, 1946, **61.** 165), in which, against a prevailing infection of moderate virulence, Strain 19 evoked a high degree of resistance by reducing the abortion rate to nearly one-eighth when employed in calfhood, its beneficial effects being demonstrated to persist, at any rate, for two successive years; but employed in adults, the benefits were not nearly so marked, the abortion rate being reduced to hardly more than one-half. Long ago, in the course of Indian experience, I had found that, even with most careful selection of a vaccinating strain, cattle exposed to a prevailing infection of exceptionally high virulence, remained wholly unprotected (*Annual Report of the Imperial Institute of Veterinary Research, Muktesar*, India, 1925). Hence, the contention that must be made that the degree of protection is but relative, and not of the same order as that evoked in human smallpox or rinderpest vaccination, in the manner the latter is now currently practised throughout India and large parts of Africa.

The question remains how to reconcile the three statements that, first, the protection evoked by Strain 19 is relative and of low grade; secondly, the necessity that remains and has been so well expressed by Mr. Wright, to vaccinate cattle repeatedly in what

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may be termed a storm-centre, such as Cheshire, where the floating herds are replenished by frequent importations of possibly highly infected cattle; and, thirdly, the comforting conclusion drawn by Mr. Lawson that a generation of practitioners is now arising which has no knowledge of "abortion storms," spreading disastrously as those of an older generation only too well knew them to spread. So phenomenal has been the subsidence of such storms following upon the widespread use of S. 19. A little reflection, drawing again upon comparative experiences, of smallpox and rinderpest, will soon show that the three statements tally perfectly.

The position has long been well understood in the case of smallpox. There, so long as the "herd immunity" is raised above a given threshold, by continuous vaccination so that the proportion of the protected population does not fall below a well ascertained percentage, then smallpox infection, even if it becomes locally established among a few individuals, stands no chance to rise up to a "storm" among the general population. Again, in India and Burma, with its many millions of cattle, it was found sadly, at first, that no effect whatever was produced in causing storms of rinderpest rising to hurricane force and spreading disastrously to abate until, with persistence, the "herd immunity" was raised so that not less than about 30 per cent. of the cattle throughout a wide expanse of territory were protected by vaccination. Thereafter, storms that were local were not stilled down until that proportion was raised further, to about 60 per cent. (*Brit. Vet. J.*, 1949, Aug.).

Hence, so long as vaccination against contagious abortion, as at present employed, is persisted with and efforts to maintain its widespread use are not relaxed, we may well continue to enjoy the happy outcome communicated to us in the concluding sentence of Mr. Lawson's introductory remarks. But, Mr. Wright has given us salutary warning as to the vigilance that must be sustained; and Mr. Anderson has, at any rate, wisely counselled us against too ready complacency.

In conclusion, the famous dictum of St. Paul may well be quoted as entirely apposite, "Prove (*i.e.*, test) all things; hold fast to that which is good." For our purposes, Strain 19 has been proved "good." Let us therefore accept it, and persist with it.

Dr. A. B. Crawford (U.S.A.: Chief, European Mission for Research on Foot-and-Mouth Disease)*: I have been associated with this problem for so many years that I welcome the opportunity to be asked to enter into this discussion. I was very fortunate in that I came into scientific work in our bureau at a time when Drs. Schroeder and Cotton were beginning their research on Bang's disease, and later with Dr. Buck, who was the originator or discoverer of Strain 19. So I was in on the programme from its inception. I know the early work that was done and all the subsequent experimental procedures conducted in our laboratory. After the death of Dr. Buck it fell to me to supervise research with Strain 19.

There are a number of things we know, but from what I have heard here so far, I do not think we know all there is to be known. Your system is slightly different, in that in our country by the use of Strain 19, we are trying to prevent infection; over here you try to prevent abortion. In other words, our aim is to certify herds as free from infection; your motives in the use of Strain 19 over here are to immunise the animals, and increase the resistance so that they will not abort. In our country we have found that if you vaccinate an older animal the vaccinal reaction will tend to persist. Our control is based on the agglutination test; therefore vaccination of the adult animal will result in positive blood reactions that more or less interfere with the use of the blood test. We used to say four to eight months of age is the optimum time for vaccination. Now we believe six to ten months is preferable, which should result in an increase in the persistence of immunity.

I quite agree with Mr. Wright that vaccination and revaccination could profitably be used in the present British method of control. But in our country we cannot do that, except in herds that are quite obstinate to our methods of control. We have not yet adopted a single method of control in our 48 States, but offer four or five selected methods based on slaughter and/or vaccination. Some of our States are slow in their work; it may be a matter of politics or education, but in those States that have done more on the progressive side we are now trying to develop more or less uniform methods of control. We have found that unless you proceed on an area basis you never can get anywhere in the control of any disease. I heartily agree that in your present conditions vaccination of the whole herd and the continued vaccination should be a normal procedure.

I hope I will not say anything which will hurt the pleasant relations which we have with you people, because I realise that the conditions that obtain here do not obtain in our country, and the views I have may be based on the views that prevail in the United States rather that those over here. We have not found, however, at our station that recovery from infection will result from vaccinating animals already infected with Brucellosis. We have done some work at the station, not enough, but we have seen no difference in the recovery from Brucellosis in animals that were not vaccinated while they were infected over those that were vaccinated.

Dr. Edwards mentioned a little while ago that he thought the increase in resistance following vaccination should not be called immunity, but pre-munity. As I understand it, that means immunity exists only so long as the organism is present in the body of the animal. Here again, I hesitate to offer a difference of opinion with any of you people, but in our work on Strain 19 we have never been able to recover Strain 19 from the body of a vaccinated animal later than 100 days from vaccination. We have made extensive research in animals that have been vaccinated for different periods, and have never been able to recover Strain 19. My opinion would be that Strain 19 vaccination is not a "premune" but an immune phenomenon. We have shown that in animals tested up to five years following their vaccination, immunity in the fifth year following vaccination appears to be as great as during the first and second years. As a matter of fact it appeared to be greater in the experiments we ran at our station.

With regard to Strain 19 and sterility, we have to agree with most people who have expressed themselves this morning. In our vaccination experiments, we have always kept a similar number of unvaccinated or control animals, and we have followed them through as many as six pregnancies; altogether we have had probably in the neighbourhood of 600 to 700 animals vaccinated and the same number controls. We have seen no difference, whatsoever, in the conception rate of these two groups. Those of you who were present on Monday and heard the discussion on infertility will appreciate the number of prime causes of infertility. It is not to be wondered at, when you consider the number of vaccinated herds, that some of these conditions causing sterility might occur. Infertility might occur under many conditions, and Strain 19 be blamed, but I do not believe Strain 19 influences fertility.

Mr. Wright mentioned the intradermic method of vaccination. We have tried this method in the United States and practically all the vaccination work in one or two States is based on the intradermic method. In other words, ·25 to ·50 c.c. of the vaccine is injected intradermically. This, of course, is quite a saving in vaccine, and ten to 20 animals may thus be vaccinated intradermically from a single subcutaneous dose. So far as we have been able to determine there is no difference in the immunity, or its persistence, between the two methods of vaccination. I do not suggest that the intradermic method be used in preference to the subcutaneous method, but in our experience, we have seen no difference in the results.

The Chairman: We did start a quarter of an hour late, and perhaps we may be allowed a little overtime; we have time for one more speaker, and then I will ask Mr. Lawson to reply.

Mr. Ingram (Oxted): I would like to congratulate Mr. Lawson on the great help he has given us on this subject.

With regard to the revaccination of cows, I would sound one note of warning. If there is any condition retarding the normal involution of the uterus, vaccination should be delayed for longer than ten days.

The Reply

I agree with Mr. Wright in that the "flying" herd, such as he meets in his practice, is the most difficult to deal with so far as vaccination is concerned. Self-contained herds, such as those dealt with in the paper, are considerably easier to manage.

The question of revaccination is often a somewhat difficult one and I do not think that one can lay down any hard-and-fast rules concerning it. Each herd should be judged on its own particular relevant circumstances and requirements. The matter is one of balance between infection and protection and naturally the highest degree of protection is required when the infection is at its highest. Once the infection has been brought under proper control it is only a matter of maintaining the protection at a satisfactory level. In many herds a single inoculation is sufficient

* Dr. Crawford prefaced his remarks with an expression of his appreciation of his "good fortune" in having been appointed the delegate to our Congress of the American Veterinary Medical Association and the conveyor, to the National Veterinary Medical Association, of the best wishes of his Association. This portion of Dr. Crawford's contribution was published in the section of our Congress Number recording the proceedings of the closing meeting, under the heading, "Tributes from Overseas Delegates."

to keep this level and take the edge off infection, but in the type of herd described by Mr. Wright, where infection is heavy and where there is considerable movement of stock into and out of any premises or where any question of re-infection crops up, in my opinion revaccination has everything to commend it.

With due deference to Mr. Wright's opinion, I do not consider that the vaccination of already infected animals will serve any useful purpose. The work Dr. Manthei carried out in America clearly illustrates this point.

The site of inoculation recommended by the Ministry was chosen after we had carried out quite an amount of experimental work using different sites, but I suppose the matter is one of opinion. We have used the recommended site throughout our work and have found it easy and handy. Whatever site is used it is essential to ensure that the inoculum is properly dispersed, otherwise fibrous "blemishes" may result.

A fall in the milk yield undoubtedly may occur in lactating cows following inoculation, but we have not been able to associate this with any particular batch of vaccine or to any particular factor, except that there appears to be a definite relationship between the fall in the milk yield and the height of the thermal reaction.

In freshly calved cows I think that it is essential that the uterus should be given a chance of returning towards some degree of normality before vaccination is carried out. We allow at least 14 days.

I was very interested to hear Dr. Crawford's observations, particularly with reference to intradermal inoculation. To the best of my knowledge the method has been used in this country only in experimental work done at Compton by the workers there.

With reference to Mr. Wright's question regarding the results of the laboratory examinations of materials at Weybridge, it should be explained that in the earlier years examinations were carried out solely to determine whether *Br. abortus* had been implicated in the abortion. Thus, between 1943 and 1946 we examined 207 foetuses forwarded by practitioners for diagnosis and of the total, 39 (nearly 19 per cent.) proved positive. In 1947-48 we commenced carrying out more detailed examinations and in the period between the beginning of 1947 and the end of June of this year we have examined a total of 682 foetuses forwarded by practitioners for diagnosis. Of the total, 133 (19·5 per cent.) proved positive for *Br. abortus*. (Cultural examinations were always followed up by biological tests.) Other organisms found were *Vibrio foetus* (to which I will refer when replying to Mr. Constance). Streptococci, staphylococci and *C. pyogenes* were also found, but never more than about 1 to 3 per cent. of cases. A high proportion of examinations proved sterile.

Mr. Constance asked about *Vibrio foetus* infection. Prior to 1947 we had occasionally met this organism, but in 1948 we isolated it from foetuses sent in from herds in which a considerable degree of infertility existed—infertility which had been attributed to S. 19. The clinical histories in the herds in question were so similar that we wondered whether the organism might be associated with the infertility, and be more pathogenic than previously had been recognised. During 1948 we carried out a considerable amount of work to try to improve our methods of isolation and recovered it in seven cases. During 1948, too, we were fortunate in meeting the Dutch workers who were working on the same problems and the contacts proved invaluable. During 1949 we isolated *Vibrio* from 16 foetuses, and in the first half of this year from eleven cases. In the majority of the herds involved infertility was, or had been, a problem. This infertility appears to have certain recognisable characteristics and the evidence we have would suggest that the condition is more widespread than has been recognised and that *Vibrio foetus* may be responsible for, or associated with, some, at least, of the infertility in bovines that has previously been undiagnosed. Earlier in the week you will have heard the views of my colleague, Mr. Deas, on the matter as it applies to Scotland.

The Chairman: I know you would like me on your behalf to offer Mr. Lawson our very grateful thanks for his paper, also the openers and subsequent contributors to the discussion—in particular Dr. Crawford. (Applause.)

Weekly Wisdom

The assumption of important positions by oversea students at British universities may be attributable to experiences in Great Britain which give them something of that sense of judgment, character and social responsibility that inspire the British educational system.—General Sir Ronald Adam, Chairman of the British Council, addressing the annual conference of the Universities of Great Britain and Northern Ireland.

NOTES ON SOME PARASITES OF CAMELS (*CAMELUS DROMEDARIUS*) IN THE SUDAN

BY

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In the course of a period of several months during which, for the purpose of another investigation, I was enjoying the hospitality and laboratory accommodation of the Sudan Veterinary Service, there arose the opportunity of making observations on some of the parasites seen, and these are briefly recorded.

Ecto-parasites

(*a*) Ticks

Heavy infestations of camels with *Hyalomma* were met, so heavy in fact that one camel died of anaemia and loss of blood from tick bites. In this case (died April 6th) there were immense numbers of nymphs and adults of *Hyalomma*, up of 100 per square inch in some places, and the ears, nostrils and anus were filled with ticks. At *post-mortem* examination there was marked pallor of the carcase, the blood was thin and watery, in appearance resembling diluted port wine. There was no clot. There was also marked congestion of the internal lymphatic glands. Figs. 1 and 2 show the heaviness of infestation which may occur.

Fig. 1.—Massive infestation of skin of camel's neck with *Hyalomma*

The infection was acquired in a sandy compound in which the camels were tethered. Other camels were disinfested by spraying with a suspension of benzene hexachloride containing "Gammexane" at a dilution of 1 in 2,000. It was prepared from an I.C.I. "Gammexane" dispersible powder (P.530), and 4 to 5 gallons were applied to each camel by spraying with a stirrup pump. To obtain maximum wetting, the nozzle of the pump was best held at 2 to 4 inches from the animal's skin and every inch of each camel was thoroughly wetted. Typical results may be seen from the table. (*Overleaf*)

All ticks attaching from the tenth to the 12th days (and possibly later, as at that stage observations were unavoidably discontinued) were on relatively hairless areas—presumably sufficient insecticide persisted in the longer coat to prevent

Fig. 2.—Heavy infestation of temporal region in camel.

Fig. 3.—Adult ticks in nostrils of camel, which have survived spraying.

Results of Spraying Heavily Tick Infested Camels with a Benzene Hexachloride Suspension containing "Gammexane" at 1 in 2,000

Observations on ticks

Camel	Ticks before spraying	1 day after spraying	At 10 and 12 days after spraying
22	Many ticks — on udder, etc.	All dead	A few ticks just beginning to feed (males).
23	" "	Dead	No ticks up to 12th day.
24	" "	Dead	No ticks (or Hippoboscids) to 12th day.
32	" "	Very many dead. One female alive.	A few fresh male ticks in axilla, and on 12th day in nostrils.
37	Many ticks, especially in groin and behind sternal pad, also Hippoboscids.	Almost all gone.	A few fresh females engorging.
38	Many ticks, especially in groin and on edges of tail.	Nearly all dead, none left on tail. Some adults moving slightly but softer, or harder than normal.	No observations.

successful attachment there. It was concluded that at a dilution of 1 in 2,000 very considerable, and in fact, almost complete removal of ticks was effected after the first spraying, and the effects lasted for ten days. If repeated at two-week intervals a cumulative effect might occur, and higher dilutions ultimately give the same effect as the first concentration. Engorging adults in the nostrils survived the spraying (Fig. 3), as also a few between the toe pads, where possibly the insecticide was removed by friction with sand. At the concentration of "Gammexane" spray used, camel scabies is readily cured and louse infestations eradicated.

(*b*) Flies

Hippobosca camelina (or *maculata*?). The Camel Fly.—(As unfortunately almost all the specimens of parasites which ... collected for specific identification were lost, this ...oboscid may have belonged to either species.)
...ese flies were found mostly in the groin or axilla and

Fig. 4.—Clusters of adult *Hyalomma* under base of tail.

appear seldom to fly. When the camels were sprayed as above, infestations with Hippoboscids were not re-established within a fortnight.

Cephalopsis titillator (syn. *Cephalomyia maculata*).—The larvae of this bot fly were found in large numbers attached to the naso-pharyngeal mucosa of most of the camels on which *post-mortem* examinations were performed. They appeared to be associated with oedema and inflammation of the pharynx and, in some cases, with a nasal discharge. In several camels the larvae were seen during life in the inferior nares (nasal turbinates) when the nostrils were being examined for the presence of ticks.

Helminths

(*a*) Nematodes

Infection of the gastro-intestinal tract (so far as could be seen) was confined to three species of nematodes.

Haemonchus longistipes.—This was present in the abomasum in large numbers in a few camels, and in two instances male worms only were found. No explanation was found for this anomaly.

Trichostrongylus probolurus.—This small worm was found in large numbers in some of the camels, and was in some cases probably responsible for emaciation and diarrhoea.

These two infections are dealt with in another paper (Steward, in press) in which the differentiation of their eggs and larvae is described, and a suitable dosage rate of phenothiazine suggested (0·6 gramme per kg. or approximately ʒi per cwt.).

Strongyloides sp.—Adult worms were not seen but the typical embryonated eggs were found in the faeces of two camels, and in cultures made from these the larvae which developed were typically those of *Strongyloides*.

Dipetalonema evansi.—Microfilariae were found in the blood of several camels. Adult filariid worms presumed to belong to this species were seen in the aorta at the *post-mortem* examinations of several camels.

Onchocerca fasciata.—Subcutaneous fibrous nodules on the side of the neck and head, and in the region of the stifle joint were found to contain coiled masses of this species of *Onchocerca*.

Fig. 5.—*Onchocerca* nodules on side of camel's head.

As the known habitat of other microfilariae of *Onchocerca* (*O. volvulus*, *O. gibsoni*, *O. cervicalis* and *O. gutturosa*) is skin it was expected that it was the most likely site for the occurrence of the microfilariae of *O. fasciata*. They were, in fact, found there when a piece of skin was excised from a camel showing the nodules. The excised skin was placed in tap water in a centrifuge tube and the microfilariae obtained from the deposit may reasonably be attributed to *O. fasciata*. They are unsheathed.

The measurements of a small number of the microfilariae gave the following results :—

	Range	Average
Length ...	0·200 mm.—0·285 mm.	0·255 mm.
Width ...	0·035 mm.—0·050 mm.	0·040 mm.

(*b*) Cestoda

The hydatid larval cysts of *Echinococcus* were present in the lungs of most of the camels examined, and in one case, a pyogenic infection was superimposed in the cyst in the lung. As the camels were not of immediate local origin, dogs were not examined for the presence of the adult stage of this parasite.

Stilesia hepatica.—Large numbers of incomplete specimens of this tapeworm were obtained from the small intestine of two camels. The *post-mortem* examination showed slight cirrhosis of the liver in one case, and cirrhosis with congestion in the other.

I am grateful to Dr. H. A. Baylis, of the British Museum (Natural History), for the specific diagnosis of this tapeworm.

Summary and Conclusions

1. Infestations of camels with *Hyalomma* may be so heavy as to be fatal. Control is possible with a "Gammexane" spray at a dilution of 1 in 2,000 of the gamma isomer.

2. Infections of camels with *Trichostrongylus* and, to a less extent, with *Stilesia hepatica* and the larvae of *Cephalopsis titillator* may be of pathogenic importance.

3. The microfilariae of *Onchocerca fasciata* occur in the skin. Measurements are recorded.

TRICHOSTRONGYLOSIS AND HAEMONCHOSIS IN THE CAMEL: THEIR RECOGNITION AND RESPONSE TO PHENOTHIAZINE

BY

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A number of camels (*Camelus dromedarius*) in an experiment at the Khartoum laboratory of the Sudan Veterinary Service displayed symptoms suggesting parasitism. *Post-mortem* examination of several animals showed a nematode infection limited to two species. These were *Haemonchus longistipes* in the abomasum and *Trichostrongylus probolurus* in the small intestine. It was considered advisable to treat these infections and in order to estimate and distinguish the effect of treatment on the two different infections, an attempt was made to differentiate the eggs and larvae of the two genera of worms. For this purpose eggs were removed from adult female worms and were measured in the usual manner with the ocular micrometer. The range of measurements (as determined on 25 eggs of each species) is shown in Table I.

Table I

	Measurements of eggs (mm.)		
	Length (range)	Width (range)	Average (length & width)
Haemonchus ...	0·06–0·08	0·04–0·05	0·07 × 0·045
Trichostrongylus	0·08–0·10	0·04–0·06	0·09 × 0·047

The eggs of *Trichostrongylus* are, in general, rather longer and wider than those of *Haemonchus*. One end of the eggs was rather rounded and the other more pointed and one side appeared flatter than the other. The most developed eggs *in utero* were more or less unsegmented, whilst those of *Haemonchus* were mostly in the two- to four-cell stage of

division. The ova of *Haemonchus* appeared more egg shaped, being widest at two-thirds from the narrower end. The morphological differences were so slight as to render identification by shape alone unreliable. The probability is that eggs over 80 microns in length are *Trichostrongylus* and where the eggs of no other genera of nematodes are present this may serve for the differentiation of these two parasites.

Usually approximately 15 eggs were found in a female *Trichostrongylus*, whereas there were many hundreds of eggs in each female *Haemonchus*. The proportion of eggs laid by the females of the two different genera is obviously important in assessing the relative importance of the two infections by faeces examination.

Differentiation of the Larvae of the Two Parasites

Faecal cultures were made with eggs, in the usual manner, obtained *ex utero* and the measurements of ten third-stage infective larvae are shown in Table II.

Table II

	Measurements of infective larvae (mm.)			
	Range			
	Total length	Maximum width	Length of oesophagus	Length of "tail"
Haemonchus	0·64–0·71	0·017–0·024	0·15–0·19	0·04–0·06
Trichostrongylus	0·64–0·79	0·020–0·024	0·14–0·16	0·03–0·04
	Average			
Haemonchus	0·67	0·021	0·161	0·052
Trichostrongylus	0·70	0·023	0·155	0·035

The "tail" is measured from the tip of the sheath to the tip of the contained larva. The infective larvae of these two genera can be readily distinguished as those of *Trichostrongylus* have short tails.

In faecal cultures from one of the camels (Number 30) a *Strongyloides*-like larva was obtained. It was not possible to associate it with any adult worms as no *post-mortem* examination was made, but in view of its similarity to the larvae of *Strongyloides* and as the faeces contained small embryonated nematode eggs, it may be regarded tentatively as belonging to that genus. The measurements are given in Table III.

Table III

Measurements of Filariform Larva Resembling Strongyloides (mm.)

Length		Width		Length of oesophagus	
Range	Average	Range	Average	Range	Average
0·57–0·64	0·615	0·014–0·017	0·015	0·24–0·27	0·25

This larva was unsheathed and the proportionate length of the oesophagus to total length was considerably greater than in the other two types of larvae, as occurs in the filariform infective larvae of *Strongyloides*.

The camels were treated with commercial dispersible powder preparations of phenothiazine originating from two manufacturers (B.W. & Co., and I.C.(P) Ltd.). It was administered in aqueous suspension from a bottle and no fasting was imposed. The effect was estimated by worm egg counts on unit volumes of faeces.

I have found that unit volume computations give less variation than counts performed on weighed samples, as the latter method is greatly affected by the natural variations in the water content of the faeces.

Egg Count Method

The unit volume of faeces chosen was about equal to a small Brazil nut. The sample was mashed with a little water and the volume was made up to 30 c.c. The suspension was then sieved to remove debris and 2 c.c. were withdrawn and placed in a 20 c.c. test tube. The tube was then topped up with 33 per cent. zinc sulphate solution and a $\frac{3}{4}$-inch coverslip was placed on the top of the full tube. After standing for 30 minutes the coverslip was removed and a count made of the eggs. Under the chosen magnification the coverslip could be examined in ten lanes of ten fields each. As the distribution of eggs is not uniform in a coverslip three or more lanes were counted, generally starting at two and a half, five and seven and a half fields along one edge. The dilution of the faeces was approximately 1 in 15 and a coverslip count was multiplied by this factor to arrive at the eggs per unit volume figure.

The effect of treatment on egg counts is shown in Table IV. In judging the results allowance has to be made for possible

Table IV

Effects of Different Dosage Rates with Phenothiazine

Case No.	Camel No.	Weight (kg.)	Dose (gm.)	Dosage rate gm./kg.	Worm egg counts (eggs per standard volume of faeces)						
					Before treatment		On days after treatment				Results
1	39	380	30	0·08	4,800	900 D	2nd, 450		4th, 4,500		Ineffective.
2	23	370	60	0·16	7,500	3,300	2nd, 1,500		4th, 3,150 T		Ineffective.
3	27	400	120	0·3	5,100	5,400	4th, 100 (some abnormal)	5th, 1,125	6th, 3,050		Ineffective.
4	28	510	180	0·35	5,100	6,000	4th, 600	5th, 3,600	9th, 1,700		Ineffective.
5	31	425	180	0·4	5,400	2,700	3rd, 75	12th, 330 +	14th, 2,900	44th, 3,500	Ineffective.
6	33	412	180	0·4	7,050	2,500 T	3rd, 75	12th, 1,500	14th, 1,650	44th, 2,000	Ineffective.
7	23	370	190	0·5	12,000		3rd, 1,050		12th, 0	14th, 650	Possibly partly effective.
8	25	400	240	0·6	3,150 mostly T, some H	4,550	3rd, 950				No further samples obtainable — inconclusive.
9	39	380	220	0·6	6,000	1,900 T	3rd, 0	12th, 100	14th, 50 T	44th, 100	Effective.
10	24	244	250	1	900 T	650	3rd, 100		12th, 0	15th, 0 44th, 0	Effective

T = *Trichostrongylus* D = Diarrhoea
H = *Haemonchus* + = Proportion hatched—true egg count will be higher.

inhibition of egg laying; this has been shown to occur by Gibson (1945), who found an inhibition of egg output by Strongyles for up to 35 days in horses which had previously received 1 gramme of phenothiazine daily for 30 days. It was fortunately possible to examine most of the camels as late as 44 days after treatment and in the two presumed successfully treated animals the egg counts were still low or negative.

Notes on Individual Cases Treated with Phenothiazine

Case No. 1 (Camel 39).—The egg count of this camel fell considerably on the second pre-treatment examination; this fall coincided with well-marked diarrhoea which effects considerable dilution of worm eggs. A very temporary reduction of eggs appears to have occurred, with a rise to the pre-treatment level by the fourth day after treatment with 0·08 gramme per kg.

Case No. 2 (Camel 23).—A slight fall in egg count two days after treatment with 0·16 gramme per kg. was followed by a rise to the previous level of over 3,000.

Case No. 3 (Camel 27).—After treatment with 0·3 gramme per kg. the egg count fell from 5,000 to 100 on the fourth day, rising by the sixth day to over 3,000. On the fourth and fifth days a proportion of the eggs was abnormal.

Case No. 4 (Camel 28).—The egg counts before the treatment of this camel with 0·35 gramme per kg. fell from about 5,000 for a few days to 600, but on the fifth day rose to 3,600, though many of these were abnormal.

Case No. 5 (Camel 31).—The egg counts fell considerably after treatment with 0·4 gramme per kg. The count of the 12th day may be abnormally low as a proportion of eggs had hatched. The egg count rose by the 14th day to pre-treatment level.

Case No. 6 (Camel 33).—The egg count of this camel fell, after 0·4 gramme per kg. of phenothiazine, from 2,500 trichostrongyle eggs to 75. By the 12th day it had risen again to nearly its former level.

Case No. 7 (Camel 23).—This camel had, after previous treatment with 0·16 gramme per kg., shown an egg count of 3,150 trichostrongyle eggs which rose to 12,000. After treatment with 0·5 gramme per kg. the count was reduced on the third day to 1,050 and on the 12th and 14th days to nil and 650 respectively. The treatment appears to have been partly successful.

Case No. 8 (Camel 25).—The pre-treatment count of 3,000 to 4,000 was reduced to 950 by the third day after treatment with 0·6 gramme per kg. and unfortunately no other samples were obtainable. The result of treatment must, therefore, be regarded as inconclusive.

Case No. 9 (Camel 39).—This animal had been previously unsuccessfully treated with 0·08 gramme per kg. and its pre-treatment count of several thousand trichostrongyle eggs was reduced, after 0·6 gramme per kg. phenothiazine, up to the 44th day, to 100 eggs or less per unit volume. Treatment is regarded as successful.

Case No. 10 (Camel 24).—A *Trichostrongylus* egg count averaging about 800 prior to treatment was reduced to nil after phenothiazine at 1 gramme per kg. Three negative examinations are recorded between the 12th and 44th days after treatment, which appears fully successful.

Discussion

Of the worms in ruminants susceptible to phenothiazine the *Trichostrongylus* species are the most resistant, and it is on their account that the higher dosage rates are used. The other nematodes which are more susceptible to phenothiazine are far less serious in sheep for instance, since routine dosage was introduced, and the trichostrongyles now appear more frequently as the cause of outbreaks of parasitic gastro-enteritis. The nematode infections occurring in ruminants are generally so mixed—usually comprising not less than six genera of worms, most of which cannot be adequately recognised by faeces examination—that there is relatively little evidence on the dosage rates required for the cure of *Trichostrongylus* infections.*

The relatively pure and recognisable double infection in these camels provided a good opportunity of estimating the effect of phenothiazine against *Trichostrongylus*. As the camel is a ruminant the results obtained probably apply reasonably closely to sheep. It is clear that dosage rates of phenothiazine up to 0·4 gramme per kg. are inadequate against this infection.

A dosage of 0·5 gramme per kg. may be moderately effective and 0·6 gramme per kg. and 1 gramme per kg. both appear to have had a marked effect. These rates appear to be very much higher than are in current use in camels. This may be because the infection with the large stomach worm, *Haemonchus*, which responds to lower doses, is easily recognisable, whilst the small trichostrongyles often escape careful search. It is interesting to note that several camels had a pure male *Haemonchus* infection.

Summary

1. A brief description is given of the eggs and infective larvae of *Haemonchus longistipes* and a *Trichostrongylus* species (probably *probolurus*), and of the infective larva of a species of *Strongyloides*. They can be recognised by faecal examination.

2. The results of treatment of the infection with varying doses of phenothiazine are recorded.

3. It is concluded that not less than 0·6 gramme phenothiazine per kg. bodyweight is required for successful treatment of Trichostrongylosis.

Acknowledgments.—I am very grateful to Major W. H. Glanville, Director of the Sudan Veterinary Services, and to J. T. R. Evans, Esq., Chief Veterinary Research Officer, for the facilities provided.

Reference

Gibson, T. E. (1945.) *Vet. Rec.* **57**. 301-303.

The Clinical Syndrome Known as "Acetonaemia"†

Dr. Scarisbrick, of Cambridge University, gave a paper which aimed at summarising the biochemical nature of ketosis in general, and in particular factors which might be concerned in bovine ketosis; a few of the many therapeutic agents used in ketosis were then discussed against the background which had been sketched out.

The starting point was the observation of the presence of acetone in the milk and body fluids. This was traced back to aceto-acetic acid and linked to the third ketone body, B hydroxybutyric acid. The aceto-acetic acid itself arose from active acetic acid and could be regarded as an overflow product. With the help of analogies drawn from the Inner Circle of the Metropolitan Railway a picture was obtained of the obscure biochemical reactions involved in the metabolism of the liver cell and the results of these on the metabolism of active acetate and hence of ketone bodies.

Specific factors influencing this and the cow towards the side

* Since this was written a paper has been published by Gibson (*Brit. Vet. J.* **105**. 309-312) to the effect that high doses of phenothiazine are required for successful treatment of *Trichostrongylus axei* infection in sheep.—J. S. S.

† Extracted from the proceedings of the meeting of the Southern Counties Division, N.V.M.A., held at Southampton on September 15th, 1950.

of ketosis were (a) lactation, (b) the ruminant method of digestion, (c) the possibility of adrenal cortex inefficiency.

The therapeutic agents magnesium, cobalt, potassium, vitamin A, vitamin B_1, insulin and glucose were then discussed, particularly as to whether and where they fitted into the above picture. It was concluded that there was no therapeutic agent with 100 per cent. success in either theory or practice.

Dr. Holmes, of Liverpool University, read a second paper which was concerned with the disease as seen clinically in the cow. He included in the term "ketone bodies" acetone, aceto-acetic acid and B hydroxybutyric acid. He regarded the condition as really only one symptom of a very complex syndrome. Many apparently normal cows in winter excrete acetone in the urine and it is therefore preferable to use milk as an aid to diagnosis, using a mixture of solid sodium sulphate and sodium nitroprusside. This test can be carried out quite easily in the cowshed.

From his own observations it was noted, amongst other things, that:

(1) The cow may excrete appreciable quantities of ketones in the milk and urine without any symptoms of metabolic disturbance being manifested.

(2) Diminished food intake from whatever cause—anorexia, unpalatable food, etc.—appears liable, in high producing cows in winter, to result in the excretion of ketones in the milk and urine. It is suggested that prolonged anorexia or fasting would probably be followed by a fall in milk yield which might, at least temporarily, counteract this effect. Hence cows should be fed on palatable foods, and all changes in feeding be introduced gradually.

(3) Multiparous cows calving in the winter period (October to February) appear more liable to develop subclinical ketosis than heifers although the condition does occur in first calvers. The condition appears most likely to arise during the period of maximum "metabolic stress"—immediately following parturition and whilst the milk yield is high.

(4) Pasture grass in spring appears to be very beneficial in reducing the incidence.

(5) Clinical data showed that the average number of days after calving to the appearance of first symptoms was 24 (16 cases), the duration of illness was 18 days (12 cases), the average blood sugar level was 32 mg. per cent. (six cases), the average plasma acetone level was 72 mg. per cent. (six cases) and the average milk yield fall 22 lb. per day (16 cases).

Bovine ketosis is characterised by hypoglycaemia and although the fundamental aetiology is unknown the following theories have been expounded:—

(1) Lack of carbohydrate.
(2) Hepatic dysfunction.
(3) Vitamin deficiency (particularly vitamin A).
(4) Endocrine dysfunction or imbalance.
(5) Alterations in rumen digestion.

Dr. Holmes had tested sufficient samples to express the opinion that acetone was not formed in the rumen in sufficient quantities to influence the ketone levels in the other body fluids. Once the animal starts to eat concentrated food the blood sugar rises, serum ketones fall and the animal makes a clinical recovery. The speaker believed that the symptoms shown in bovine ketosis are those of liver dysfunction consequent upon fatty infiltration and changes in the glycogen/fat ratio in the liver cells.

Among a wide variety of substances used therapeutically, Dr. Holmes had investigated the use of glucose in some detail as he believed its use was rational in view of the low B.S.L. He found the B.S.L. returned to normal following a glycosuria within about two hours after intravenous injection, and hence preferred the subcutaneous route. Molasses or other forms of sugar by mouth resulted experimentally in a negligible rise in the B.S.L. due to their rapid fermentation in the rumen. In fact they would seem to be contra-indicated as they produced transient acetonuria due to the sudden influx of large quantities of fatty acids from the rumen. The fact that feeding grass in the cowshed does not seem to have the same beneficial effect as when it is grazed may be associated with breakdown of muscle glycogen during exercise.

In opening the discussion Mr. J. M. Ingram said that he recognised and had confirmed acetone in the milk under the following conditions:—

(1) The cow which was normal in every respect, feeding, and milking well, but the owner complained of the odour from the milk.

(2) In hypocalcaemia (a) ordinary, or (b) delayed type.

(3) In hypomagnesaemia.

(4) Accompanying a foreign body and usually but not always in the milking cow at that period when being stall fed.

(5) With a subacute metritis.

(6) This type was first described to him by Imrie and occurs during winter months in cows three to six weeks calved. The animal rapidly loses weight, drops in milk yield and will not eat concentrates but will eat all the hay allowed. The faeces are dark, firm in consistency with a glazed shiny coating. Formalin administered in 2 drachm doses two to three times daily, well diluted, appeared to be a perfect answer. In recent years, however, this variety is not so prevalent, or it merges more into the

(7) Type in which even the appetite for fodder is greatly diminished so that the animals will eat only a little over-heated brown tobacco-smelling hay or a mouthful of various tempting foods.

Most of these do respond to glucose therapy in 6 oz. doses intravenously every second day.

It is his custom, when all else has failed, to resort to the use of 2 to 3 drachms of formalin in up to 1 pint of water intravenously. This gives rise to a certain amount of shock with accelerated breathing and lachrymation which subside within 30 to 40 minutes. It is not 100 per cent. effective but it has saved many cases which obviously were going to die.

In the considerable general discussion which followed, Mr. Barker, Jnr., mentioned the use of acid-sodium-phosphate and of chloral hydrate. Mr. White remarked on the beneficial effects when milking was temporarily suspended. Mr. Thompson queried whether the use of sulphonamides in cases where acetonaemia was complicated by infection, *e.g.*, metritis, might not affect the rumenal flora. He thought that in order to prevent the break up in the rumen of glucose or molasses when administered *per os*, it might be useful to mix them with copper sulphate, in the hope of closing the oesophageal groove. He had seen typical symptoms of acetonaemia develop due to water lack in cows tied up when faulty water bowls blocked. Mr. Forrest had not had any reaction to subcutaneous injections of glucose solution provided they were given at body temperature. Messrs. Hall-Patch, Pook, Foden and Smith of Christchurch also spoke.

In the reply, Dr. Holmes said that after trials with protein hydrolysate he had not found it as good as glucose and very much more expensive. He described in detail Paterson's modification of Rothera's test for acetone which could be carried out very conveniently in the cowshed. He thought the problem centred round the fatty liver and that the answer was probably to be found in some drug which would remove this excess, but had not found choline of any use. Dr. Scarisbrick queried this conception of the condition but agreed that the use of insulin was contra-indicated.

ARTIFICIAL INSEMINATION IN SCOTLAND

The progress of artificial insemination in Scotland is reviewed by the Scottish Milk Marketing Board in its "News Letter" for November, 1950. It was on December 1st, 1949, that the Board's Cattle Breeding Centre at Southbar, Inchinnan, was started; and during the first year of its operation, nearly 5,000 cows belonging to 775 breeders have been inseminated. In addition to the main centre at Southbar there are now three sub-centres —at 1, Wellington Square, Ayr; at Invercloy, Brodick, Arran; and at the R.N. Air Station at Machrihanish, near Campbeltown. Service is now available for breeders throughout the entire counties of Renfrew and Dunbarton, the greater part of Ayrshire, the Island of Arran, the Kintyre Peninsula in Argyll, seven parishes in the Lower Ward of Lanarkshire and four parishes in Stirlingshire. Every effort is being made to extend the area. The fee for life membership is £1 and for annual membership 5s.; and it is pointed out that membership is not confined to milk producers who are registered with the Board.

CLINICAL COMMUNICATION

A NEW TAENIACIDE FOR DOGS

J. K. BIDDIS, M.R.C.V.S.,

ILFORD

The incidence of tape-worm infestation in the adult dog population appears never to vary, and there is therefore a steady demand for an effective taeniacide.

A safe taeniacide which causes no discomfort to the dog, and the minimum of effort on the part of the owner, would naturally have preference with the small-animal surgeon. If, in addition, the drug is well tolerated and no vomiting occurs after administration, as happens with many otherwise good preparations, the usefulness of the drug is further enhanced.

The chemical substance 2 : 2'-dihydroxy-5 : 5'-dichlorodiphenylmethane* was first reported upon and used successfully in dogs by American workers. Their published evidence, supported by *post-mortem* examinations following experimental work, confirmed that the drug is responsible for an unusual mode of action. The tape-worms are subjected to a rapid degenerative process within the intestinal tract, and this results in their excretion in unrecognisable form in the faeces.

I first used the drug on greyhounds which had been obstinate to other preparations. They had been passing segments persistently for 12 months, often within five to seven days following treatment. The results with the new drug described were spectacular, *i.e.*, no further segments appeared after the day of administration. As more of the drug became available a further number of obstinate cases were treated, with similar success. Over 50 cases, including breeds other than greyhounds, have been dealt with effectively in this manner, and in many instances there was a noticeable betterment in the general condition of the patient. This was confirmed in several greyhounds, where within a short period of time following treatment there was an appreciable increase of bodyweight.

ADMINISTRATION

The recommended dose is 0·50 gramme to every 6 lb. bodyweight, but smaller doses, *e.g.*, 0·50 gramme to every 8 lb. bodyweight, have been found equally effective. The dose is given immediately before the normal main meal of the day, subsidiary feeds being withheld on that day. No purging effect is to be expected, but isolated cases have been noted where purging occurred six to nine hours after administration. Any attempt to promote defaecation, either by purgation or exercise, is contra-indicated.

SUMMARY

1. The drug appears to be remarkably well tolerated, even in dosage well beyond therapeutic level.

2. No preparation of the patient is necessary, either before or after administration of the drug, other than the withholding of subsidiary meals on the day of treatment.

3. Based on clinical observation only (the usual clinical method of assessing an anthelmintic), the desired effect was obtained in all treated cases.

* The brand of the drug used in these cases was "Dicestal" (May & Baker).

ABSTRACTS

[Leptospirosis in Cattle. BAKER, J. A., & LITTLE, R. B. (1948.) *J. Exp. Med.* **88.** 295–308. (6 plates.)]

The authors give a full account of the infective agent, obtained from the milk of cows showing general symptoms of disease, and secreting milk having a bloody or thickened yellow appearance. This account follows a preliminary report by the same authors in 1946 (*Proc. Soc. exp. Biol.* 1946. **63.** 406).

As a result of transmission experiments in guinea-pigs, rabbits, embryonated eggs, mice, lactating cows and young calves, it has been shown that the agent is a spirochaete.

In the cow artificial infection produced variable symptoms, from an inapparent infection with normal urine, to fever and albuminuria, to haemoglobinuria followed by death. A generalised infection occurs with localisation in the kidney. Abnormal milk is a dominant feature. Antibodies were detected in the sera of experimental animals and cows recovered from the natural disease.

As regards the spread of infection, it is suggested that urine which contains the spirochaete may, when secreted on to a concrete floor, cause a spray of droplets some of which could be inhaled by nearby animals. Moreover, since the agent occurs in the blood during early stages and infection can be passed on experimentally by subcutaneous inoculation, insect vectors must be considered as a possible epidemiological factor.

P. K.

* * * * *

[*Histoplasma capsulatum* Infection in a Dog. OSEBOLD, J. W. (1950.) *N. Amer. Vet.* **31.** 461-462.]

The author gives an account of the disease in a dog together with *post-mortem* findings, and discusses the disease in man, pointing to the danger of transmission from dogs to man.

The case reported was a cocker bitch which had a history of chronic diarrhoea for a year. It was showing extreme emaciation, dehydration and tenesmus. Temperature was normal. Faecal examination was positive for whip worm ova, and negative for coccidia and Giardia.

Treatment—with sulphathalidine, penicillin, streptomycin and atabrine, together with treatment of symptoms—had no effect on the course of the disease and death followed. On *post-mortem* examination noticeable features were a large pale liver, pale spleen, thickened walls of the intestine and greatly enlarged mesenteric lymph nodes, which were yellow in colour and firm.

Microscopically the swollen organs showed extensive infiltration with mononuclear cells, in which were varying numbers of a yeast-like fungus, *Histoplasma capsulatum*. Disintegrating mononuclears were seen which released the fungus into surrounding tissues.

The fungus is a human pathogen, causing a similar disease in man, 20 per cent. of cases occurring in children under two years of age. Infiltration of the bone marrow may result in leucopenia and anaemia. The disease is usually fatal.

Diagnosis is by demonstration of the fungus, by culture, blood smear or biopsy.

P. K.

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[A Technique for the Collection of Nematodes from the Alimentary Tract of Sheep. HAMILTON, F. J. (1950.) *Aust. J. Agric. Res.* **1.** 93–98.]

A technique is described which facilitates the separation and collection of the abomasal and intestinal nematode worms

of sheep. An essential part of the technique is an apparatus consisting of two wide-mouthed jars, each with a sieve an inch from the bottom. Two glass tubes are passed through the stopper of each jar. One tube empties on to the sieve, while the second tube draws the sieved material from the bottom of the jar. Two jars are fitted in series; the inlet tube of the first jar is fitted with a pipette, and the extracting tube of the second jar is attached to a suction pump. Therefore, material sucked by the pipette is drawn through the two sieves within the jars before passing into the pump. The sieves are of varying mesh, being 16 linear inches (0·047 square inch) and 40 linear inches (0·017 square inch).

The routine method of collecting the worms and sieving the gut contents is used, and the collected material is washed into shallow trays. The worms are then sucked into the pipette and subsequently collected on to one or other of the sieves within the jars. These sieves are washed, and the process repeated, when the worms should be free of ingesta.

For the collection of Trichostrongyle species, the diluted intestinal contents should be allowed to sediment and the supernatant fluid drawn off to clear some of the ingesta before using the pipette and jars. For these small worms a third jar and sieve should be added to the series.

D. W. J.

REVIEW

[Sheep Management and Diseases. H. G. Belschner, D.V.Sc., H.D.A., Deputy Chief, Division of Animal Industry, Department of Agriculture, New South Wales, and external lecturer, sheep diseases, Faculty of Veterinary Science, University of Sydney. Sydney and London: Angus & Robertson. 1950. Pp. 718. 75s.]

This book, written primarily for the student and stock farmer in Australia, provides a wider range of information on sheep husbandry and disease than is available in any other single volume. Much of the information, particularly on certain aspects of management, is peculiar to Australia or to countries where the merino breed predominates, and where the production of wool rather than mutton is the chief objective. The student will not find information on the systems of husbandry practised in Britain, but if familiar with one or more of these systems, the emphasis on the Australian conditions should add interest to the study of this book. Throughout references are given to scientific papers, reports and bulletins upon which much of the information given is based, and these reports, etc., many of which are Government sponsored, are quoted freely.

The data, whether it be on the construction of a fence or a footbath, the feeding or breeding of sheep, etc., or on the prophylaxis and treatment of disease, is presented with greater emphasis on practical detail and application than is found in the more diffusely chatty works on sheep husbandry popular among British authors. Moreover, the book is illustrated by reproductions of photographs nearly all of which are well selected, and numerous diagrams and tables supplement the text, adding clarity and interest.

Approximately the first half of the book is concerned with sheep husbandry. The remainder deals with disease. In the sheep husbandry section the importance of wool production is shown by the considerable space given to a description of shearing operations, shearing sheds and yards, and to information on wool, its classification, grading and marketing. It is interesting to find that a chapter of 48 profusely illustrated pages devoted to "blow-fly strike" is included in the husbandry and not in the disease section. In this chapter the modified Mule's operation for the removal of breech skin folds and the consequent prevention of "strike" is described and illustrated in detail. Formerly there was a fashion for the introduction of wrinkly skinned American merinos into Australian flocks in the belief that thereby heavier fleece would be obtained. Unfortunately the wrinkly skinned sheep were very susceptible to "breech strike" and this necessitated the Mule's and comparable operations for the removal of excessive folds of breech skin that became soiled by urine and attracted the blow-fly. The alleged advantages of the wrinkly skinned sheep so far as wool production is concerned were not found to be real and the smoother skinned merino has recovered popularity.

The feeding of sheep is dealt with fully and the practical nature of the information is exemplified by the tables on the supplementary feeding requirements of sheep when the pasture is in varying degree insufficient, and by tables which make it a simple matter to select from a number of foodstuffs at current market prices the foodstuff which will supply the requirements of the sheep at the most economic price. The purpose and value of adequate recording is explained and examples are given of the information entered in stud books; the use of stud ewe and stud ram cards and paddock books, etc., is illustrated.

The section on disease begins with a short and elementary account of the anatomy and physiology of the sheep. On the page devoted to the respiratory system there are the following practical observations: "The normal colour of lung is pink, but this colour varies in a sheep that has been opened up, depending on the amount of blood contained in the lung. If the sheep has not been bled the lungs will be dark in colour and the depth of colour will depend on the side the sheep has been lying. This dark colour of the lungs should not be confused with a disease condition. Normal lung floats in water, but if it is diseased, for example, solidified as a result of pneumonia, it will sink. The lungs from an unborn lamb will also sink in water because it has never breathed." In the following chapter, headed "Sickness and Mortality of Sheep," the techniques for conducting a *post-mortem* examination and for the collection of specimens for laboratory examination are described and illustrated.

The diagnosis, prevention, and control of the more important diseases—infectious, non-infectious and parasitic—are dealt with adequately, and there are chapters on the diseases of the wool and skin, poisonings, and the treatment of wounds and fractures. The information is clearly presented and the course of action well defined for the owner who has to control disease in his flock without professional aid at the farm. Exception may be taken to the advisability of some of the suggestions that are made, *e.g.*, in a paragraph under the heading "Removing a Dead Lamb" it states: "Under paddock conditions, flushing out of the uterus with weak antiseptic solutions is hardly practicable. Should, however, any facilities be available, such as a piece of rubber tubing and a funnel, the uterus may be washed out with clean water." It was surprising to find two formulae for intratracheal injections for lung worms, and also to read a description of treatment by fumigation, treatments now largely discredited. In dealing with copper and cobalt deficiencies no reference is made to the economic importance of these in Australia. But the defects are few and do not appreciably detract from a very successful and informative work.

There are three appendices, one of which is a very helpful glossary of sheep and wool terms.

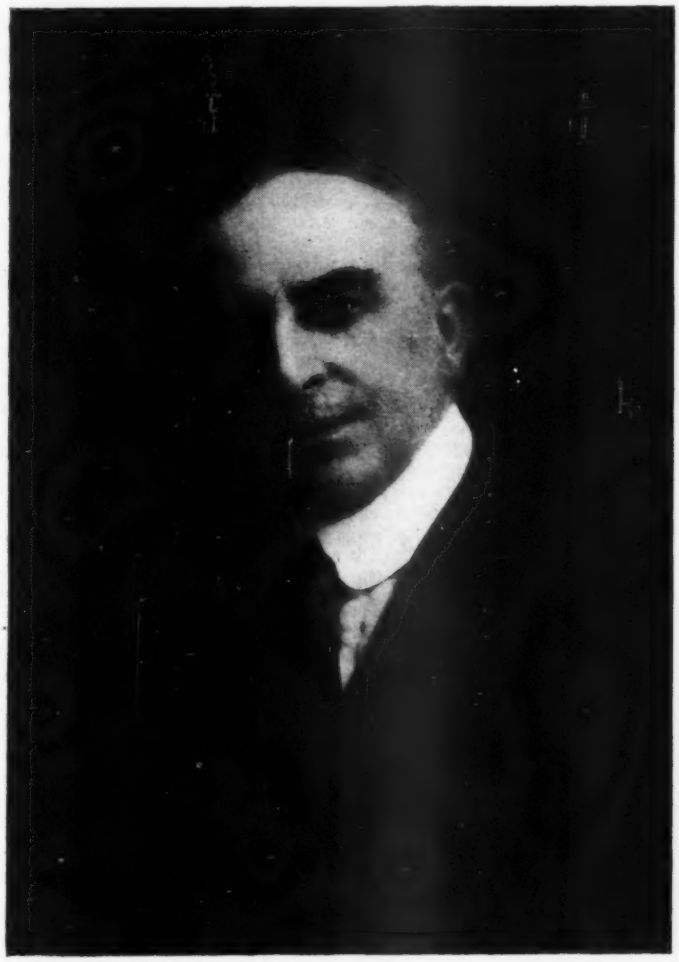
The book is one of the Australian Agriculture and Livestock Series. To all interested in sheep husbandry, veterinarians and agriculturalists it is highly commended.

MEMOIR

EMERITUS PROFESSOR SHARE JONES

In the passing of Emeritus Professor Share Jones a pioneer in the field of Veterinary Education has gone from our midst.

John Share Jones was born at Cefn, in Denbighshire, North Wales, in 1873. He was the son of a well-known farmer, Thomas Jones, of Plas Kynaston, and he received his early education at schools in the neighbourhood of his home. When as a young man he exhibited a desire to become a veterinary surgeon his father sent him to the Royal Veterinary College, London, where he came under the influence of men like M'Fadyean, Shave, MacQueen and Penberthy. He also studied at King's College and University College, London, and he was very proud of having worked under Starling and Henry Power. His student career was an outstanding one, and he gained a number of prizes at the College, including the much coveted Centenary Prize in his final year.



After obtaining his M.R.C.V.S. diploma in 1900 he was appointed a Tutor in Surgery and later a Demonstrator in Anatomy at Camden Town. In 1904, however, the University of Liverpool established its School of Veterinary Science and Share Jones was appointed Lecturer in Veterinary Anatomy. From that date his energies were devoted tirelessly towards the development of that school.

At Liverpool Share Jones at once came into contact with Sir Rubert Boyce, then Professor of Pathology at the University. It was largely due to the keen interest of Boyce in comparative pathology and in veterinary science that the new school was instituted, and he proved to be a veritable tower of strength to the young veterinarian who was as yet only just beginning to find his feet. Throughout his life Share Jones was never tired of acknowledging his indebtedness to Boyce and to Dale, the University Vice-Chancellor, for the sympathy and encouragement which he received from them in those early years. Dale it was, by the way, who suggested that Share Jones should continue to reside at Wrexham—more than an hour's railway journey from Liverpool—in order that the sphere of influence of the veterinary school in Liverpool might extend to North Wales and the border counties. And it was Dale who was responsible for stimulating his interest in local government affairs, an interest which proved to have such a profound effect upon his life in later years.

In 1906 the University recognised his administrative ability and he was requested to act as Secretary of the Board of Veterinary Studies, and in 1917 he was appointed the first Director of Veterinary Studies. During these years he proved himself to be an excellent teacher for he was a fluent and convincing speaker who was also a master of his subject. His research work, too, was marked by an extraordinary breadth of vision. This work included a study of the comparative anatomy of the ungulata, work on the surgical anatomy of the horse (on which he published a treatise in four volumes) and studies, the results of which he published in the form of numerous contributions to professional and other journals, on such subjects as veterinary and agricultural education, animal husbandry, meat production and livestock insurance. In 1907 he became a Fellow of the Royal College of Veterinary Surgeons and three years later he was awarded the degree of M.Sc. of Liverpool University.

In 1915 the University conferred upon him the Doctorate of Veterinary Science, this being the first occasion for the degree to be awarded. Four years later the University established a chair in Veterinary Anatomy and Share Jones was appointed Professor. An honorary doctorate, too, was conferred upon him by the University of Berne at the centenary celebrations of that University in 1934 for his work, as the citation read, "in expanding the conception of his science and increasing the possibility of its service to the community, thereby advancing the cause of university education. Again, at home, his scientific and literary work for the profession earned him in 1928 the Steel Memorial Medal of the Royal College of Veterinary Surgeons, and in 1939, shortly after his retirement, Liverpool University honoured him with the title of Emeritus Professor in recognition of his conspicuous services to the University.

Of his work on behalf of the Liverpool Veterinary School during those 35 years a great deal could be written. His task there was never an easy one, indeed a man with less courage would have failed. In those early days the University received no specific government grant in respect of its veterinary school which was, therefore, dependent upon friends from within and without the profession for its very existence. Few realise by what a slender thread hung the destinies of the school until in 1925, through the initiative of Share Jones, the Development Commissioners were persuaded to award a capital grant to the University for the erection of new veterinary buildings, and an annual grant for their maintenance. Thus the crisis was averted and there dawned a new era in the life of the school. Throughout those difficult

times no one was more conscious of the shortcomings of the school than Share Jones himself, but his enthusiasm and his optimism remained undaunted, and he would be the first to defend the University against any criticism. He had set out to make university education for veterinary students a success, and he pursued this end with determination confident of ultimate victory. He was a brave fighter, and he was always at his best when, at University Senate or Veterinary Board meetings, or in public debate, the scales were weighted against him. On big issues, once he was convinced of the righteousness of his cause, he would fight to the last ditch. He had implicit trust in his friends but he found it very difficult to tolerate any suggestion of faint-heartedness or disloyalty.

Interested as he was, of course, in his own subject of anatomy, Share Jones was particularly concerned that the knowledge gained from the study of anatomy should be applied to the solution of problems in other branches of veterinary science. He would discourse at length on the importance of the subject, declaring that no one was really competent to express an opinion on an animal, be it alive or dead, unless he had studied anatomy. Thus he was acutely aware of the importance from an economic point of view of the subject of animal husbandry. Indeed, it would probably be right to say that he regarded his greatest work to be the focusing of public opinion upon the husbandry of animals rather than crops as the most important branch of the agricultural industry. This brought him into the public eye both on the platform and in journalistic correspondence. The campaign began as early as 1914 when he was invited to submit a scheme for higher agricultural education in Wales. In this scheme he showed clearly that he was a man of vision, for he proposed the institution in one of the colleges of the University of Wales of a complete faculty of Animal Husbandry and Veterinary Science. He persisted throughout his life in stressing the importance of animal husbandry and was rewarded in 1929 when the Liberal Party, of which he was a staunch supporter, adopted in its statement of policy before the general election the view that animal husbandry should be recognised as the branch of agriculture responsible not only for the production of animals used for food, but for the control and distribution of their products and by-products.

Professor Share Jones took an active interest in politics both inside and outside the profession. He was a member of the Council of the Royal College of Veterinary Surgeons for 38 years, and at the time of his retirement from that body, in June last, was the Father of the Council. He was a Vice-President in 1914, and would undoubtedly have been made President in the following year but for the fact that his views on the one portal system of entry into the profession were at that time opposed to those of the majority of the Council. Here again was an instance of the man being in advance of his time. Amends were made, however, for in 1928 he was elected President. In the affairs of the N.V.M.A., too, Share Jones took an active if not a conspicuous interest. He served for a period on the Council of the parent body and was a member of a number of local societies, being made President of the North Wales Division in 1928, and a few years later being appointed the first President of the Welsh Branch of the Association.

In public life outside the profession he served on his local Parish Council at Cefn for many years, and he was also a member of the Wrexham Rural District Council of which Council he was Chairman from 1938 to 1941. He was also Chairman of its Health Committee over a long period of years. As a result of his extensive knowledge of local government he realised the benefit which the profession would reap if it could secure representation in Parliament, and in 1929 he gladly accepted the invitation of the Liberal Party in the Oswestry Division of Salop to stand as its candidate at the general election. This entailed a considerable sacrifice for his health at the time was not good. He put up an excellent fight, and although he was not returned, he was proud of the fact that he had greatly increased the Liberal poll.

He served on many Departmental Committees, such as the Read Committee on the staffing of the Veterinary Departments in the Colonies, and the Martin Committee on the Reconstruction of the Royal Veterinary College. Other organisations with which he was associated were the Court of Governors of the University College of North Wales, the National Federation of the Meat Traders Association, the Ministry of Agriculture Livestock Advisory Committee, the North Wales Joint Livestock Committee, and the Land Settlement and Training Association for Rural Development. He was also a foundation member of the Wrexham Rotary Club.

In December, 1938, he retired from his chair at Liverpool University. One might have expected a man who had served his generation so well during his active life to relax somewhat from this time on. But the war came and he immediately looked for opportunities to serve his country. He and his wife decided that they would offer their home at Pentrebychan Hall, Wrexham, as a hostel for the blind evacuated from the adjacent cities, retaining a small portion for their own use. Then when the rationing of coal became necessary he volunteered to act as local fuel overseer for the Wrexham district. He enjoyed this work immensely, for it afforded scope for his still active mind and his gifts of organisation. In recognition of these services he was awarded the M.B.E. in 1948. During these latter years, too, when veterinary education was in process of being taken over by the universities, he continued his efforts to persuade the University of Wales to establish a veterinary school in the principality. For Share Jones was proud of his native land, and was intensely anxious that full facilities should exist in Wales for training young Welshmen to enter the veterinary profession.

In these and in many other ways Share Jones did much to attract attention to the value of veterinary science to the nation. His was a very full life, and he was active in mind and body until the end. He influenced the lives of Liverpool graduates over many decades, instilling them with a sense of the true value and grandeur of their profession, and encouraging them to worthy service. The profession mourns the loss of one who was at the same time both a great leader and a loyal servant, and Liverpool graduates in particular will ever remember affectionately one to whom they owe so much.

His widow, Dr. Mary Share Jones, herself a graduate in arts, medicine and law, has been his devoted companion over many years. After a life of activity in the spheres of medicine and social welfare she lives in well-earned retirement at Wrexham, and to her is extended the deepest sympathy of the profession. Sincerest condolence is offered also to Professor F. H. Manley, their nephew, who holds a post of high responsibility at the School of Veterinary Medicine in Alabama, U.S.A.

H. V. H.

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The Funeral

Representatives of local authorities and of Liverpool University attended the funeral on December 6th. A service at the house was followed by interment at Wrexham Borough Cemetery. The Revs. Ezekiel Williams and Jones Davies officiated.

The chief mourners were Dr. Mary Share Jones (wife), the Rev. and Mrs. Jones Davies (step-sister), Mrs. Williams Price, Cefn (niece), Capt. and Mrs. W. L. Jackson, London, Mrs. J. T. Evans, Miss G. Evans, Mr. Reginald Evans (cousins), Miss E. G. Williams, Dr. A. M. Williams (nieces), Mr. J. Williams (brother-in-law), Mrs. Lloyd Evans, Mr. J. H. Davies, Mr. A. Owen Griffith (cousins), Mr. Howel Evans (nephew), Mrs. T. Evans (niece). Relatives who were unable to attend were Mrs. R. Williams and Mrs. S. Manley (sisters), Mrs. D. Davies, Ruabon, Mr. and Mrs. J. Williams, Mrs. J. Isaacs, Mr. and Mrs. J. Wood, Leicester, Mrs. E. S. Williams, Australia, Mrs. A. G. Jones, Chicago, Dr. and Mrs. F. H. Manley, Alabama (nephews and nieces).

Among those present were the Mayor of Wrexham (Councillor William Clarke), Town Clerk (Mr. Philip Walters, who represented the Association of Welsh Local Authorities), the Borough Treasurer (Mr. Cyril Morris), Mr. W. E. Bufton (Clerk of the Denbighshire County Council), Mr. Trevor Williams (Clerk, Wrexham Rural District Council, representing Alderman E. A. Cross), Mr. Edward Boden (Chairman, Wrexham R.D.C.), Aldermen Gethin Davies, W. F. Humphreys and T. Lloyd Williams, Mr. Llew Davies (Registrar), Mr. Maurice V. Evans (East Denbighshire Coroner), Mr. W. T. Collins (representing Senior Regional Officer for Wales of the Ministry of Fuel and Power), Mr. E. M. Williams (Marketing Dept., North Western Division, N.C.B.). Dr. T. P. Edwards (Medical Officer of Health), Professor J. G. Wright, Liverpool University, Mr. Howel V. Hughes (representing National Veterinary Medical Association and Mr. Isherwood Secretary, Board of Veterinary Studies at Liverpool University), Mr. Stanley Dumbell (Registrar, Liverpool University), Mr. H. W. Dawes (representing Royal College of Veterinary Surgeons and the Royal Veter-

inary College), Messrs. C. Wentworth-Elam and J. W. Dransfield, Liverpool University, Mr. W. Forgrave (representing North Wales Division, N.V.M.A.), Mr. B. Hughes (President, Wrexham Rotary Club), Mr. E. Richards, Major Aston (representing Alderman William Aston), Mr. J. Desmond Griffiths (representing Chairman and Secretary, Wrexham and District Retail Meat Traders' Association), Mr. T. Henderson (representing Mr. J. I. Ellis, Denbighshire Travel Agency), Messrs. W. F. Aston, G. Wyse, H. V. Kitching, Hubert Parry, Ben Lyke, Robert Edwards, Josiah Davies, William Thomas, John Rowley, Iorwerth Williams, V. Griffiths, Brynley Roberts, R. W. Gittins, Geo. Leyland, W. Francis, J. Williams, C. M. Butterworth, R. Johnson, K. O. Williams, D. H. Rees, R. H. Morgan and J. R. Morgan. Col. R. Fenwick Palmer was unable to attend owing to illness.

Among those who sent wreaths were:—The Governors and Staff of the Royal Veterinary College; President and Council of the Royal College of Veterinary Surgeons; President and Council of the National Veterinary Medical Association; the Staff of the Veterinary School; the Staff of the Department of Veterinary Anatomy, Liverpool University; President and members of the Wrexham Rotary Club; Staff of the Fuel Office, Wrexham R.D.C.; the Mayor and Mayoress of Wrexham; and the North West Division of N.V.M.A.

NOTES AND NEWS

Diary of Events

Jan. 4th.—Meeting of the Central Division, N.V.M.A., at the Royal Veterinary College, N.W.1, 5.30 p.m.

Jan. 5th.—Meeting of the Association of Veterinary Teachers and Research Workers, the Department of Agriculture, The University, Leeds, 10 a.m.

Jan. 8th.—Meeting of the Association for the Study of Animal Behaviour, in the meeting room of the Zoological Society of London, Regent's Park, N.W.8, 11 a.m.

Jan. 10th, 11th, 12th, 1951.—Meetings of Committees and Council, R.C.V.S.

Jan. 27th.—Meeting of the Biochemical Society, in the Post-graduate Medical School, Ducane Road, London, W.12, 10.30 a.m.

Jan. 27th.—Meeting of the British Association of Allergists, at the Royal Society of Medicine, 1, Wimpole Street, W.1, 2.30 p.m. (Discussion on Veterinary and Comparative Allergy).

Jan. 31st.—Royal (Dick) Veterinary College Annual Ball, in the Assembly Rooms, George Street, Edinburgh, 8.30 p.m.

QUARTERLY MEETINGS OF COUNCIL AND STANDING COMMITTEES N.V.M.A. DURING 1951

The following dates have been fixed for meetings next year, chiefly to give members plenty of time to reserve hotel accommodation

In London

Monday, January 22nd:

2.30 p.m. Parliamentary and Public Relations Committee.
3.30 p.m. Veterinary State Medicine Committee.

Tuesday, January 23rd:

10 a.m. Home Appointments Committee.
11.30 a.m. Organising Committee.
2.15 p.m. General Purposes and Finance Committee.

Wednesday, January 24th:

11 a.m. Council.

In London

Monday, April 16th:

2 p.m. Organising Committee.
4 p.m. Parliamentary and Public Relations Committee.

Tuesday, April 17th:

10 a.m. Veterinary State Medicine Committee.
12 noon Home Appointments Committee.
2.15 p.m. General Purposes and Finance Committee.

Wednesday, April 18th:

11 a.m. Council

In Edinburgh

Wednesday, July 11th:

11 a.m. Home Appointments Committee.
2 p.m. Organising Committee.
4 p.m. Parliamentary and Public Relations Committee.

Thursday, July 12th:

11 a.m. Veterinary State Medicine Committee.
2 p.m. General Purposes and Finance Committee.

Friday, July 13th:

11 a.m. Council.

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Sick Horses Detained in Veterinary Hospitals

Arrangements have been made with the Government Departments concerned for a special basic ration of 2 cwt. feeding-stuffs (in the proportion of 2/3rd oats and 1/3rd bran) per month for each horse detained for operation or treatment in a veterinary hospital as from January 1st, 1951.

The ration will be based on the number of horses detained during the month preceding the date of application.

Rations for part of a month will be calculated at the rate of ¼ cwt. for each seven sick "horse days" or less.

Application forms for hospitals domiciled in England and Wales may be obtained from the Ministry of Agriculture and Fisheries, Domestic Livestock Rationing Section, Block E, Government Buildings, Lytham St. Annes, Lancs. In Scotland, application forms will not be required and written application should be made to the Department of Agriculture for Scotland, Government Buildings, Bankhead Avenue, Sighthill, Edinburgh, 11.

An application form marked "Supplementary" may be submitted to the appropriate Department to meet any abnormal influx of sick horses for which availab'e coupons are not sufficient.

The above allowance is in addition to, and distinct from, the existing limited arrangements where special rations are required for medical treatment against a veterinary certificate.

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PERSONAL

Appointment to Council, R.C.V.S.—The University of Bristol announces the appointment of Professor C. W. Ottaway, PH.D. (CANTAB.), F.R.C.V.S., to be the University's second representative on the Council of the Royal College of Veterinary Surgeons.

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GENERAL OBITUARY

Major Durham Matthews

In the death of Major Durham Matthews, O.B.E., J.P., High Sheriff of Norfolk in 1944, which took place at Newmarket on December 16th, at the age of 74 years, the Veterinary Educational Trust has lost a staunch advocate and supporter. Apart from the Army, in which he had a distinguished career, his great enthusiasm in life was his love of horses: in his earlier years he had been a notable rider to hounds and in point-to-points. After his final retirement from the Army in 1919 his colours were often to be seen on the course, particularly at the meetings at Newmarket, where he had a house. From its inception he took a great interest in the Veterinary Educational Trust and was chairman of its bloodstock industry committee. In 1946 he offered his house at Newmarket free of rent for a period of years to the trust for research work into the diseases of horses, and it is in use as a specialised library and museum.

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LEGAL NOTES

Accident on Highway Caused by Straying Animal

An important judgment as affecting horse owners and highway users, respectively, was delivered by the Master of the Rolls in the Court of Appeal on December 19th, when the Court allowed an appeal by the defendant, Mr. R. J. Richards, of Summer Court, near Newquay, from a decision of Judge Rawlins, given at Newquay County Court on October 4th last, awarding the plaintiff, Mr. Wesley Frederick John Brock, £28 11s. 8d. damages.

The action—says *The Times* (Law Report, issue December 20th)—was brought to recover damages for injuries caused to the plaintiff on January 13th last while he was riding a motor-cycle in the

dark on the main road from St. Austell to Newquay. As he was passing a field owned by the defendant a mare belonging to the defendant leapt over the hedge bordering the highway and landed on his cycle. He was thrown to the ground, but escaped serious bodily injury. He sued the defendant in the county court for damages for negligence in failing to keep the mare under proper control, and the county court Judge gave judgment in his favour and awarded him £28 11s. 8d. as damages in respect of damage to himself, to the cycle, and to his clothing.

The mare was over five years old, but had never been broken, and appeared to have been kept by the defendant, who was a farmer, as a pet for his wife.

JUDGMENT

The Master of the Rolls said that on the evidence he would have been disposed to hold that the mare, though not vicious or savage, was of a character which could fairly be described as mischievous. But the county court Judge had negatived that view and had accepted the evidence of the defendant's wife that the mare had a sweet nature and was in no way dangerous, and that her only unusual character was her propensity to stray. It was impossible to say that there was no evidence to support the Judge's finding of fact, and the question was whether on that finding the judgment in favour of the plaintiff could be supported. The general law was laid down in Searle v. Wallbank (63 *The Times* L.R. 24; [1947] A.C. 341), and in view of that decision he (his Lordship) felt that the judgment could not stand.

There was no obligation on the owner or occupier of a field adjacent to a highway to maintain a fence on the border of the highway. And, except in cases concerning animals with peculiar characteristics, there was no general duty, founded on the principles stated in Donoghue v. Stevenson (48 *The Times* L.R. 494; [1932] A.C. 562), on the owner of domestic animals to prevent them straying on to the highway and causing risk of accidents to users of the highway. There was no liability to have a fence; and if there was a fence no liability arose if it was not properly maintained.

But in a case where an animal was known to have such characteristics as might endanger users of the highway there was a duty to prevent it getting on to the highway. A special propensity to stray could not by itself be regarded as imposing that duty. To create liability there must be something amounting to viciousness or mischievousness. An animal of savage disposition, or which was dangerous owing to its frolicsome behaviour, had propensities against which its owner had a duty to guard.

Here the county court Judge had accepted the evidence that the mare had no such propensities; whether that was a right conclusion was a matter for serious doubt, but there was no appeal from the county court on questions of fact unless it could be held that there was no evidence to support the finding.

His (his Lordship's) conclusion in law was that as a general proposition the owner of animals was under no duty to prevent them straying, even though the straying might take the form of leaping over a hedge on to a highway at a lower level. To create liability the animal must be known to have some peculiarity which would render it dangerous on the highway, and if there was evidence in the present case to suggest that the mare had such peculiarities the finding of the county court Judge on the facts was wholly to the contrary. The appeal must therefore be allowed. He could not help feeling sympathy for the plaintiff, not the less so because of his (his Lordship's) doubt with regard to the findings of fact in the Court below.

Lord Justice Singleton and Mr. Justice Vaisey also delivered concurring judgments.

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AREA ERADICATION PLAN FOR TUBERCULOSIS

In the following notice, issued recently by the Ministry of Agriculture and Fisheries, there are summarised the provisions of three Orders which have just been made by the Minister of Agriculture and Fisheries for giving effect to the Area Eradication Plan for Tuberculosis.

The Minister of Agriculture and Fisheries has made the Tuberculosis (Area Eradication) Order, 1950, the Tuberculosis (Slaughter of Reactors) Order, 1950, and the Tuberculosis (Compensation) Order, 1950. These three general Orders, which come into operation on January 1st, 1951, provide the machinery for carrying out the area eradication plan for tuberculosis introduced on October 1st, 1950.

The provisions of the Tuberculosis (Area Eradication) Order, 1950, will apply to every area declared by local Order to be an Eradication Area or Attested Area. They include a prohibition against movement of cattle into such an area except under licence or on certain transit journeys, and a power to prohibit the movement of cattle on to or off particular premises in such an area; and apply many of the rules and requirements of the Tuberculosis (Attested Herds) Scheme, 1950, with certain modifications and additions, to premises, occupiers of premises and to animals kept on premises in an Eradication Area or Attested Area.

The Tuberculosis (Slaughter of Reactors) Order, 1950, empowers a veterinary inspector of the Ministry to require the owner or person in charge of a bovine animal kept in an Eradication Area or Attested Area to detain and isolate the animal, if the Minister proposes to slaughter it. The Order also provides for the mode of ascertainment of the value of an animal for compensation purposes, and gives the owner of an animal valued at more than £100 the option of removing the animal under licence to premises not situated within any Eradication Area or Attested Area. The compensation payable by the Minister for an animal which he causes to be slaughtered is prescribed by the Tuberculosis (Compensation) Order, 1950, and is normally an amount equal to its market value subject to a maximum of £100. The market value of an animal is defined as meaning the price which might reasonably have been obtained from a purchaser in the open market who had no knowledge that it had been tested with tuberculin.

It is intended to make local Orders at an early date declaring as Attested Areas three small island areas which are already free from tuberculosis, namely, the County of Zetland, the Isles of Scilly, and the islands of Arran and Great and Little Cumbrae in the county of Bute. These areas will then become subject to the provisions of the Tuberculosis (Area Eradication) Order, 1950.

Copies of the Tuberculosis (Area Eradication) Order, 1950, the Tuberculosis (Slaughter of Reactors) Order, 1950, and the Tuberculosis (Compensation) Order, 1950 (Statutory Instruments, 1950, Nos. 2,006, 2,007, and 2,005), may be purchased directly, price 3d., 2d. and 1d. respectively, from H.M. Stationery Office at the following addresses:—York House, Kingsway, London, W.C.2; 429, Oxford Street, London, W.1; 13a, Castle Street, Edinburgh, 2; 39, King Street, Manchester, 2; 2, Edmund Street, Birmingham, 3; 1, St. Andrew's Crescent, Cardiff; and Tower Lane, Bristol, 1; or by post (4d., 3d. and 2d. respectively) from P.O. Box No. 569, London, S.E.1.

SOUTH-WEST WALES ERADICATION AREA

Notice has already been given by the Minister of Agriculture of his intention to declare as an Eradication Area on October 1st, 1952, an area consisting of the county of Cardigan, the county of Carmarthen (except the Bettws Mountain district) and part of the county of Pembroke.

Following local consultations, it has been decided that the part of Pembroke to be included in the Eradication Area shall be the whole of the Petty Sessional Divisions of Kemes and Kilgerran; and the parishes of Dinas, Llanllawer, Llanychlwydog, Llanytchaer, Pontfaen, Morvil, Henry's Moat, Maenclochog, Llys-y-fran, New Moat, Vorlan, Llanycefn, Bletherston, Llandissilio West, Grondre, Llanfollteg West, Llawhaden, Llanddewi-Velfrey, Robeston Wathen, Newton North, Mounton, Narberth, Narberth North, Narberth South, Crinow, Lampeter Velfrey, Ludchurch, Crunwear and Amroth.

As already announced, the Ministry is providing free tuberculin tests in the proposed Eradication Area itself and also in the remainder of the county of Pembroke, in the Bettws Mountain district (*i.e.*, the parish of Bettws and such parts of the parishes of Ammanford Urban and Cwmamman Urban as lie to the south of the River Amman), and in that part of Glamorgan west of the Swansea valley, including the Gower peninsula.

It is hoped that in October, 1951, the Minister will be in a position to give notice that these districts will be added to the Eradication Area in 1953.

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SWINE FEVER IN SCOTLAND

Presiding at the sixth annual meeting of the Scottish Pig Producers' Association, Mr. G. Honeyman Tennent referred to the 15 per cent. increase in the Scottish pig population in 1950, and said that the value of the pig industry to the community was now being recognised to a much greater extent than was formerly the case. But it was alarming, he added, to see the return to the Scottish herds of the terrible scourge of swine fever. He did not say that swine fever could not originate in Scotland, but the facts showed that the recent waves of the disease had originated in pigs brought in from England. "We have suggested as an emergency precaution," he said (reports the *Farmer and Stock-breeder*), "that there should be a stoppage in the traffic in pigs from England."

Mr. W. Laird reported on a meeting held between representatives of the Ministry of Agriculture and the National Farmers' Union of Scotland on the problem of dealing with swine fever.

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

SWINE FEVER:

Essex.—Duck End, Stebbing, Chelmsford, Essex (Dec. 18th).

Dumfries.—West Cluden Hall, Irongray, Stewartry of Kirkcudbright, Dumfries (Dec. 18th).

Lincs. (*Lindsey*).—Pyewipe Farm, Brigg, Lincs.; West Wold, Deepdale, Barton-on-Humber (Dec. 18th).

Perthshire.—Birch Cottage, Wolfhill, Guildtown, Perth (Dec. 16th).

Renfrewshire.—Corseford Piggery, Howwood, Renfrewshire (Dec. 16th).

Yorks (*E.R.*)—Styes at the rear of Salutation Inn, 19, Cannon Street, Hull, Yorks (Dec. 16th); c/o Mrs. R. Smith, Main Street, Bubwith, Yorks (Dec. 18th)

Yorks (*N.R.*).—Ainderby Hall, Ainderby Steeple, Northallerton, Yorks (Dec. 16th).

Yorks (*W.R.*).—Church Lane, Garforth, Leeds; Manor Farm, Prince of Wales Road, Darnall, Sheffield (Dec. 16th); 101 Station Road, Kiveton Park, Rotherham, Yorks (Dec. 18th).

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Research Grants for the Far East 1949-50

During the financial year ending March 31st, 1950, 13 grants totalling £209,888 were approved from the central research fund set up under the Colonial Development and Welfare Acts towards research schemes in Colonial territories in the Far East. A description of the schemes, which appears in the H.M.S.O. publication "Colonial Research: 1949-50" (Cmd. 8063), shows that seven of the grants were made to the Federation of Malaya and Singapore, two to North Borneo, one to Sarawak, and three to the region generally. Research activities during the year fell broadly into three categories—economic, medical and sociological—and, in some cases, were supplementary to schemes approved in previous years [see November 13th, 1948, and September 3rd, 1949, Vol. 3, "Science and Research"].

Many of these schemes are being assisted by substantial contributions from the Colonial Governments concerned, out of their own revenues. In addition, supplementing research schemes financed from Development and Welfare funds, is the work being carried out by Government Departments in the various territories on such problems as improved rice strains, agricultural techniques, better-quality rubber clones, and malaria control.

To date, the total sum approved under the Colonial Development and Welfare Acts for research in the Far East Colonial territories amounts to £768,379. Particulars, by territory, are given in the following table:—

Territory	Economic	Social and medical	Total 1949–50	Grand total 1940–50
Far East General ...	141,144	—	141,144	163,419
Federation of Malaya	24,244	34,363	58,607	429,095
Singapore	—	3,715	3,715	10,824
Hong Kong	—	—	—	135,500
North Borneo ...	—	3,297	3,297	10,977
Sarawak	3,125	—	3,125	18,564
Total	168,513	41,375	209,888	768,379

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LIVESTOCK EXPORT GROUP

The Report of the Livestock Export Group for the Quarter ended September 30th, 1950, states that the figure of 300 animals which passed through quarantine and was subsequently shipped during the Quarter shows a highly satisfactory increase of almost 270 per cent. compared with that of 112 animals in the similar period last year, a rise in exports to Canada and the U.S.A. being largely responsible for the increase. Direct shipments to Canada and the U.S.A. are also up by over 55 per cent. The grand total (468) shows an overall increase of 212 per cent.

Over 160 head of cattle have so far been registered for shipment to Australia which is greatly in excess of the number on the register at the same time last year. In the period December 1st, 1949 to the end of May this year, 114 head of cattle were shipped to that Dominion.

But for alterations still being carried out at the Glasgow Quarantine Station, which has prevented full use of accommodation and caused disappointment to exporters by the exclusion of their animals, the number of animals shipped to Canada and the U.S.A. would have been greater. The Group has, however, been assured by the Ministries of Agriculture and Supply that everything possible is being done to expedite completion of work in hand at an early date.

Eire.—A deputation from the Group was received by the Ministry in August when the question of dispensing with the necessity for quarantine in this country of livestock for export to Eire was discussed. Despite the Group's views that there is no need for quarantine, the Ministry are inclined to support those of the Eirennean Veterinary Authorities that some measure of quarantine is required and that it be continued in this country. A slight concession has, however, been made in a recommendation that, instead of undergoing quarantine, animals from Scotland be isolated on the farm for a period of 14 days before shipment and for a similar period on the farm of destination upon arrival in Eire.

Japan—Pigs.—Following representations by the Group, the Board of Trade has replied that in regard to the import of pigs into Japan from the U.K., the Japanese Ministry of International Trade in Tokio states that the United Kingdom would receive its fair share of licences when this trade is re-opened. Japanese breeders have emphasised that they are desirous of importing British pedigree pigs.

France—Poultry.— The Board of Trade have notified the Group that the import into France of day-old chicks is governed by a quota which has now been completed.

The Group strongly emphasises the need for, and hopes that, adequate representation will be made on behalf of the poultry industry of the country when future quotas are being negotiated. The Secretary for Overseas Trade has been requested to press this point in regard to France.

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CAT-SCRATCH AND TULARAEMIA

In an annotation appearing under the above heading in its issue of December 16th, the *Lancet* observes: "Human infection with *Pasteurella septica* is now a recognised sequel to bites by cats and other animals which carry the organism in their mouth or respiratory tract. Such infections usually have a sudden onset with swelling and redness of the injured area followed by a benign course, but sometimes the inflammation persists a long time and osteomyelitis may be discovered after the initial lesion has healed.

"Cats are thought to be the source of another infection, known in France as 'la maladie des griffes de chat.' Debré and his colleagues,[1] who have seen several cases, describe an example in a girl of six, who developed a small tender swelling in the groin without any other lesion in the limbs or perineal region. Despite treatment with penicillin the lump grew and the skin over it became discoloured and adherent. Aspiration produced pus, from which no organisms could be grown on the various culture media tried. The girl's Frei and tuberculin skin tests were negative, but an intradermal test with an antigen prepared from the pus of a similar case was strongly positive. The abscess discharged for some days but responded fairly rapidly to 'Aureomycin.' The child had no history or sign of claw marks, but she habitually played with cats at home. This case is typical of many seen recently in the country round Paris. The lesion is a subacute suppurative lymphadenitis involving one or several nodes and leading to an abscess which may reach 2 inches to 3 inches in diameter. There is little general reaction except for mild fever and sometimes a leucocytosis, though Weill and Lévy[2] have noted enlargement of the spleen in one case.

"This condition seems to be distinct from the infections with *Past. septica*, but so far bacteriological and mycological examinations have not revealed its cause. Virus infection is a possibility, especially as cats and mice are often infected with viruses of the psittacosis-lymphogranuloma group. Another explanation is put forward by de Lavergne and colleagues[3] in their clinical review of the first epidemic of tularaemia in France. They point out that cat-scratch infection resembles one of the varieties of tularaemia, and the skin-test antigen prepared from cat-scratch pus has produced a positive reaction in several proved cases of tularaemia. It is known that cats occasionally harbour *Past. tularensis*, but in the case reported by Debré *et al.* the child's agglutination test for tularaemia was negative. Application of this test in other cases of cat-scratch should quickly determine whether the two conditions are related."

REFERENCES

1 Debré, R., Lamy, M., Jammet, M. L., Costil, L., & Mozziconacci, P. (1950.) *Bull. Soc. méd. Hôp. Paris.* **66.** 76.

2 Weill. J., & Lévy, P. *Ibid.* 967.

3 de Lavergne, V., Pierquin, J., Helluy, J., & Dornier, R. (1950.) *Sem. Hôp. Paris.* **26.** 3978.

MEAT IN AMERICA

Mr. W. T. Baker, J.P., of Birmingham (Immediate Past-President of the Institute of Meat), addressing an open meeting of meat traders from the Wessex and Isle of Wight Council's area at Southampton, on November 27th, on "My Impressions of the Meat Industry in the United States," said, reports *The Meat Trades Journal*, that the meat industry of America and the vast stores that had been set up there by the large combines were different in every respect from what we saw in Great Britain. The Americans had gone into the industry more scientifically and thoroughly and had put the same amount of care into it as they had put into all their other industries. All the hotels, restaurants and eating houses always bought direct from the large stores, which meant that the general butcher had no trade in that direction. The wholesalers did the whole of that business, which was the most extensive business in the meat trade. That was a matter of great thought for the retailers. He was convinced that any retailer who opened a meat shop in America would have a very rough time and would have great difficulty in making a living without an enormous amount of capital to start with. Meat was sold in most of the large food stores in America, and shops opened in all districts by the large combines were the biggest competitors to the general butchers.

In regard to self-service stores, Mr. Baker said some of them were marvellous. He was convinced, however, that they had no future in this country so far as the individual trader was concerned. They could only be run by a big combine with plenty of money. There might be some future for them here, but he was not very optimistic about it. It was a most amazing thing that in all the "Help Yourself" stores there was always a department for meat.

Alluding to meat prices in America he quoted the following: two leg of lamb chops (13 oz.), 4s.; breast of lamb (14 oz.), 1s. 9d.; rib of beef or chine steak (14¼ oz.), 6s. 4d.; buttock steak (1 lb. 1 oz.), 5s. 3d.; sirloin of beef (5 lb. 4 oz.), 25s. 2d.; porterhouse steak (1 lb. 10 oz.), 8s. 9d.; loin of pork (3¼ lb.), 12s. 5d. Those prices, he thought, gave some idea of the enormous price of food in America.

Mr. Baker also said that very few people in the States had their meals at home. Consequently the retailer as we knew him had little or no future in America. The Americans were a great meat-eating nation, but the waste one saw in hotels and restaurants was appalling. There was something wonderful about America, which was a great nation, he added, but one was always jolly glad to be back in dear old England.

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FOWL PEST ORDER

The Ministry of Agriculture announced on Christmas Day that from the previous day an Order would be in force throughout England and Wales restricting the movement of live poultry as much as possible, and prohibiting the congregation of birds at markets and on other premises except for poultry intended for immediate slaughter.

The Ministry fears there has recently been widespread dispersal of a form of Newcastle disease (fowl pest) through the movement of infected birds. Veterinary officers are tracing all suspected birds as quickly as possible, but some time must elapse before the extent of infection can be known.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the N.V.M.A.

FERTILITY OF DAIRY CATTLE: THE MANAGEMENT FACTOR

Sir,—The question of what level of fertility should be expected in cows is of considerable interest at the present time when varying degrees of infertility, especially in dairy cows, seen to be an increasing difficulty. The figure of one calf each 12 months is frequently considered to represent 100 per cent. fertility in cows. In a report from Ceylon which came to my notice recently, Turbet gives an account of cattle breeding on various Government farms which were under his care in Ceylon. One of these farms was stocked with cattle of the small local breed known as the Sinhala breed. This breed is valued mainly for the strength and activity of the bulls as cart-cattle. The cows are poor milkers. The herd reported on by Turbet was started some 15 years ago by purchase of a few cows selected in various parts of Ceylon as typical specimens of the breed. They are maintained mainly on grazing with some cut fodder, especially during periods of drought, and a small ration of concentrate food when in milk. The fertility of these cattle under these conditions has been exceptionally high. Turbet has tabulated the breeding history of 44 cows, that is all the cows in the herd which have had more than one calf, covering 272 pregnancies, the average interval between calvings works out at 11·6 months. The records of some of the individual cows which have been longest in the herd are worthy of note, for example:—

Cow's No.	*No. of Calves*	*Interval Between Calves in Months*
K.1	17	11·56
K.2	12	11·55
K.3	14	11 30
K.4	14	11·61
K.5	15	11·00
K.9	8	12·57
K.11	8	13·10
K.15	11	10·70
K.16	11	11·70

The milk yields of these cows are low, about the best being K.3, which has averaged 150 gallons over 14 lactations. The figure of 150 gallons does not give the full amount of her yield as the calves are allowed to suckle and no estimate is made of the quantity taken by the calf. The true yield therefore is 150 gallons into the bucket plus some unknown quantity taken by the calf. The lactation periods are short, being seldom over 250 days.

The age at first calving is high as compared with standards for dairy breeds of cattle in this country; Turbet states that in this particular herd it has been three years and 183 days.

These figures would appear to give some support to the theory that low fertility is a not unnatural consequence of modern methods of dairy cattle management, these methods being associated with a very high plane of nutrition and breeding for early maturity and high milk yields.

Yours faithfully,
M. Crawford.

Commonwealth Bureau of Animal Health,
Veterinary Laboratory,
Ministry of Agriculture and Fisheries,
New Haw, Weybridge.
December 18th, 1950.

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OEDEMA DISEASE OF SWINE

Sir,—Judging from the reports of the N.V.M.A. Congress of September last, the earliest records of this disease would appear to date back to 1932 in Northern Ireland with the first published reports by Shanks in 1938.

In 1916 I first encountered in Stourbridge, Worcs., the typical oedema affecting the stomach wall. These were mostly isolated deaths in cottagers' pigs in thriving condition, of varying ages and weights, with a history of sudden death.

Prior to this, as far back as 1909 oedema of the mesentery had been noted in the Southern Counties of England. These, again, were mostly cases of sudden death in thriving strong stores.

Colleagues who had encountered similar *post-mortem* findings in varying parts of England could throw no light on the subject.

Lack of research facilities, coupled with the then obsession of the "Powers that be," in their search for the elusive swine fever ulcer, offered no incentive to enquire into its etiology. The cases were accepted, as were many other interesting and valuable *post-mortem* findings, as something inexplicable, buried 6 feet in a covering of lime and forgotten.

What a wealth of knowledge of disease conditions in pigs was committed to the grave with little if any attempt at tabulating or collating the information for the benefit of the pig industry and the country at large.

Whilst the disease in those early days did not assume so much economic importance as to-day, there is little doubt of its early existence in a sporadic form.

Yours faithfully,
J. O. Powley.

Scriven House,
99, Station Parade,
Harrogate.
December 18th, 1950.

BD. PER. GEN.